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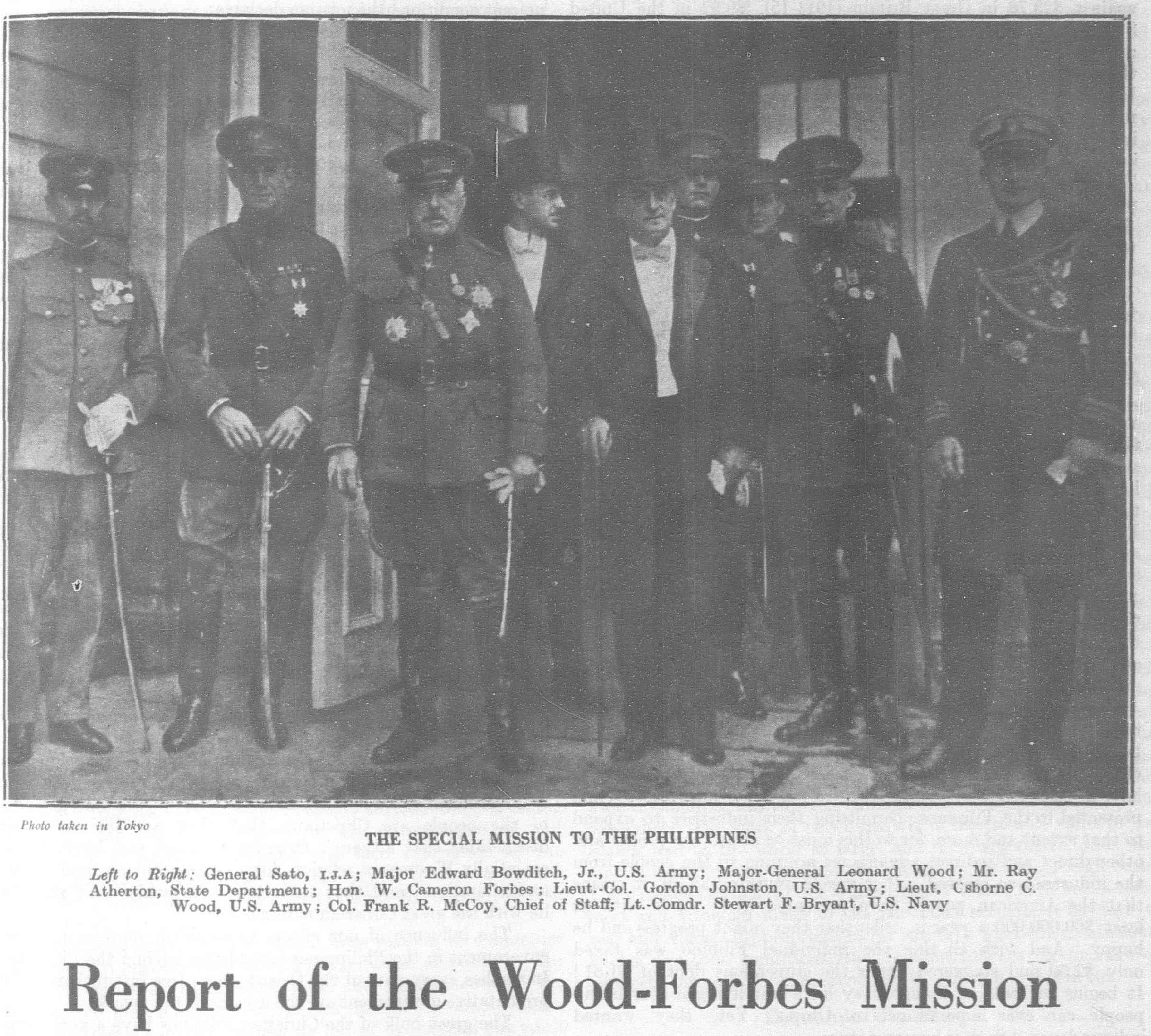

Photo taken in Tokyo

THE SPECIAL MISSION TO THE PHILIPPINES

Left to Right: General Sato, I.J.A; Major Edward Bowditch, Jr., U.S. Army; Major-General Leonard Wood; Mr. Ray Atherton, State Department; Hon. W. Cameron Forbes; Lieut.-Col. Gordon Johnston, U.S. Army; Lieut, Csborne C. Wood, U.S. Army; Col. Frank R. McCoy, Chief of Staff; Lt.-Comdr. Stewart F. Bryant, U.S. Navy

Report of the Wood-Forbes Mission

THE report of the special mission to the Philippines under the chairmanship of Major-General Leonard Wood and Hon. W. Cameron Forbes is remarkably clear in its presentation of actual conditions and emphatic in its findings that the islands are not yet prepared to shoulder the responsibilities attached to independence, and under no circumstances should the American government permit the establishment of a situation in the Philippines which leaves it in a position of responsibility without authority. To achieve this it is recommended that congress declare null and void all legislation which has diminished, limited or divided the authority granted the governor-general under the Jones act.

The mission found that the people are not organized economically or from the standpoint of national defense to maintain an independent government, a conclusion that was inevitable from such matter of fact observers who, in summing up, said that even with the many excellent qualities of the Filipinos, the experience of the past eight years, during which they have had practical autonomy, has not been such as to justify the people of the United States relinquishing supervision of the government of the Philippines, withdrawing their army and navy, and leaving the islands a prey to any powerful nation coveting their rich soil and potantial commercial advantages. Were the United States to withdraw from the islands and terminate their relationship without giving the

Filipino the best chance possible to have an orderly and permanently stable government, it would constitute a betrayal of the Filipino people, a misfortune to the American people, a distinct step backward in the path of progress and a discreditable neglect of national duty.

One of the first steps of the new governor-general has been to prepare the way for the organization of a proper defensive force and the report clearly shows that the Filipinos are well able to stand taxation for the maintenance of such a force. The per capita taxation in the islands was only $2.50 in 1920 against $23.78 in Great Britain (1914-15), $9.92 in the United States (1914-15), $5.57 in Japan (1915-16), $17.33 in the Argentine and $7.79 in Brazil, or a lighter per capita taxation than any of these countries. One reason for this light burden is because the United States has borne all the costs of military and naval establishments necessary for the defense of the islands and other expenses incidental to the maintenance of the sovereignty of the islands, including international diplomatic and consular representation. The bonded debt of the islands in 1920 was $22,000,000 or $1.81 per capita, compared with $25 in Cuba, $237 in the United States, $853 in England and $1,159 in France. The Dutch East Indies with $1.92 per capita, is the nearest to the Philippines and China next with a little less than double that of the islands.

In these figures alone are shown some of the benefits attached to being a citizen of the Philippines under the paternal and beneficent rule of Uncle Sam. No wonder they clamored for independence, and thought not of consequences, and wanted the United States to accept all responsibility without exercising authority. An illuminating feature of the benefits derived from the connection with the United States is seen in the matter of free trade which they now enjoy. In 1920, says the report, nearly $40,000,000 of sugar was exported to the United States, the duty on which would have been six to eight per cent. of its value, according to its polarization. It is problematical, the report goes on to say, how well Philippine sugar could have stood the handicap of eight per cent. added to the high cost of freight from the Philippines to the United States. The value of cigars exported to the United States was $10,500,000 and the duty on these at the present rate would amount to about $30,000,000, which, if it had been paid, would have closed the markets of the United States to these cigars. There would also have been a similar closing of the American markets to Philippine leaf tobacco. The trade in embroideries now valued at $7,500,000 a year would have to pay a duty of $4,500,000. As there is no other market for this product, the industry would have been ruined. In these few items alone we get a glimpse of what free trade with America means to the islands. Here we have at least $37,000,000 taken out of the American treasury, and presented to the Filipinos, permitting their industries to expand to that extent and more, for to this must be added the profits and other direct and indirect advantages accruing to the people from the industries so created. If it means anything at all, it means that the American people have presented their wards with at least $60,000,000 a year in order that they might progress and be happy. And with all this the individual Filipino was taxed only $2.50 and staggered under the stupendous debt of $1.81! It begins to look as though they have been living as near as any people can ever hope to get to Utopia. Yet, they wanted independence. Such is human nature.

* * *

The body of the report deals with, first, the purpose and instructions of the mission as set forth in the letter of President Harding to the secretary of war and the letter of instructions from the latter to Major-General Wood, which, amongst other things, bears on the more important strategical position and future of the islands in the following words:—

> "The Filipino people have for ages, due to the fact that the sovereignty of the Philippine Islands rested first in Spain and then in the United States, been protected in the ownership of territory and potential wealth out of all proportion to that of their neighbors. It is important to determine whether reasonable plans exist for the utilization of these resources by the Filipino people in order that their unused land and resources my not continually be a source of temptation to their less fortunate, but probably stronger neighbors, and whether on the withdrawal of a strong sovereignty from these islands these resources would remain exclusively available for the Filipino people."
>
> "Certainly it would be a vain thing to turn the Philippine Islands over to the Filipino people without reasonable assurance that the resources of the islands would remain the heritage of the people of the islands. The pleasing of the Filipinos of this generation would be a minor satisfaction if it were believed that it would result in the bondage or destruction of the Filipino people for all time hereafter."

The report than goes on to outline the travels and investigations of the mission and gives a historical sketch of the islands and an analysis of the character of their people. Coming to present conditions the mission declares:

Present Conditions

There has been a progressive transfer of government to the people of the islands, and at the present time it is very largely in their hands. So extensive has been the transfer that many fail to realize that there still continues in the islands a decisive American control that assures the maintenance of an orderly government, secure against disturbing influences from within and without.

In view of the difficult situation which existed after the insurrection, the difference in language, customs and in conceptions of citizenship obligation, the progress which has been made in the twenty-three years of American occupation is extraordinary. It is a high tribute to Americans and Filipinos alike. The animosities have disappeared and there remains a spirit of confidence and friendliness for the American people throughout the archipelago. Much has been done, but much remains to be done.

While there has been retrogression in the efficiency of most departments of the government during the past few years, we do not feel that the responsibility for this rests solely upon the Filipinos or that they should be unduly blamed for such failures as have occurred, as the ultimate responsibility for the selection of responsible officers and for the exercise of proper supervision was in the hands of the American governor-general, whose duty it was to exercise due care to appoint competent men at the heads of departments and bureaus, and, above all, to exercise proper supervision over them.

A reversal of policy is not needed now, but time for the Filipinos, under careful but friendly supervision, to absorb and master what is already in their hands. We must remember that the good qualities of the people, their enthusiasm and their determination, cannot take the place of experience.

We must build up an informed public opinion, a stronger spirit of civil responsibility and a better appreciation of the obligations of citizenship. In this the island press has a vitally important part to play. The task of building up a truly representative form of government is made much easier by the fact that the great bulk of the people are Christians, that they are free from caste distinctions, that although Oriental in blood and birth, they are essentially Western in religion, form of government and in ideals and aspirations, and that their true sympathies and affiliations lie with the great Christian nations.

The influence of our efforts to establish representative self-government in the Philippines extends far beyond the Philippines. It reaches every part of the Orient where free institutions and representative government are the dreams of the people.

The great bulk of the Christian Filipinos have a very natural desire for independence; most of them desire independence under the protection of the United States; a very small percentage desire *immediate independence with separation from the United States*; a very substantial element is opposed to independence, especially at this time. The Moros are a unit against independence and are united for continuance of American control and, in case of separation of Philippines from the United States, desire their portion of the islands to be retained as American territory under American control. The Pagans and non-Christians, constituting about 10 per cent. of the population, are for continued American control. They want peace and security. These the Americans have given them. The Americans in the islands are practically a unit for the continuance of American control.

The people, as a whole, are appreciative of the peace and order which prevails throughout the islands. Many do not understand what independence means, or its responsibilities. They are living under the best conditions they have ever known. It is not generally realized that the American government cannot be expected to assume responsibility for the results of internal disorders, particularly as they affect the nationals of other powers, the treatment of foreign capital and external political relations, unless the United States retains a certain measure of control.

The great work which the American commercial population and organizations have done in the islands should not be overlooked. It has contributed greatly to the betterment of conditions. They have built up and established business and credit from one end of the islands to the other. They have always been a strong force in the support of law and order, intensely American in sentiment and, on the whole, a good, stabilizing and helpful influence. At times they have been impatient, and justly so, with the discouragement of American business efforts and there have been conditions which have given rise to strained relations between individuals Americans and Filipinos, but never resulting in any disturbance of public order.

The American and foreign church missions and schools and charitable associations have done much to improve the spiritual and physical condition of the people, and to build up better relations between the Filipinos and Americans.

Generally speaking, administrative departments of the government are topheavy in personnel and enmeshed in red tape. There is a vast amount of paper work. The methods of the administration are purely bureaucratic. There is a lack of supervision and personal contact.

The general administration of the Philippine government in 1913, the period of greatest efficiency, was honest, highly efficient and set a high standard of energy and morality. Inherited tendencies were being largely replaced by American ideals and efficiency throughout the Philippine personnel, but the time and opportunity were both too short to develop experienced leaders and direction in the new English-speaking and American-thinking generation. Both the political and administrative leaders were still Spanish-trained and Spanish-speaking, and many are so to-day.

It is the general opinion amongst Filipinos, Americans and foreigners, that the public services are now in many particulars relatively inefficient; that there has occurred a slowing-down in the dispatch of business and a distinct relapse towards the standards and administrative habits of former days. This is due in part to bad example, incompetent direction, to political infection of the services, and, above all, to lack of competent supervision and inspection. This has been brought about by surrendering, or failing to employ, the executive authority of the governor-general and has resulted in undue interference and tacit usurpation by the political leaders of the general supervision and control of departments and bureaus of the government, vested by law in the governor-general.

Again, the legislature has passed laws tending to demoralize and introduce into the civil service the infection of politics. For example, numerous exemptions from the requirements of the civil service and many provisions for temporary employment. All these defects can and—unless we fail to understand the spirit of the legislature and the leaders—will be corrected in the islands.

Public order is maintained principally by the constabulary, a force of approximately 5,800 officers and men. This organization has proved itself to be dependable and thoroughly efficient. In discipline, morale and appearance it still bears the strong impress of the carefully selected officers of the United States army who organized, trained and developed it.

This force, excellent as it is, is designed to meet the police needs of the situation in time of peace. There is no adequate local organization of the Philippine people for defense of the islands against aggression. The American government should at once take the necessary steps to organize, train and equip such a force.

There has been some lowering of standards, due principally to the sudden loss of the bulk of the experienced American officers, who left the service to enter the world war, and to the effects of the low rate of pay which resulted in many leaving the service; also to the demoralizing, and at times intimidating, effect of political influence, the detached nature of their duties, in frequent inspections and frequent change of officers. But on the whole this force is a very satisfactory one and is entitled to great credit for its morale, efficiency and orderly effective performance of duty.

Some years ago a school for constabulary officers was organized and has been in operation with excellent results. No men are now appointed to the constabulary who are not graduates of this school, where they have undergone a careful preparation and training. The quality of the graduates shows what can be accomplished when opportunity for careful training is offered.

Public order is excellent throughout the islands, with the exception of minor disturbances in the Moro regions, due principally to energetic and sometimes over-zealous efforts to hasten the placing of Moro children, especially girls, in the public schools, and to the too sudden imposition upon the disarmed Mohammedans of what amounts to an obsolute control by Christian Filipinos. It is also due in part to failure to give adequate representation in local governments to Moros.

The report then takes up the administration of justice which may be briefly summarized in the statement that approximately 50,000 cases are pending in the courts to-day, including some 8,000 probate and guardianship cases. Conditions are steadily growing worse and with present personnel and methods the dockets will never be cleared. In brief, the administration of justice is unsatisfactory, slow and halting, with a widespread feeling among the people that political, family and other influences have undue weight in determining issues. The land title office also comes in for sharp criticism. In 1913 the insular government had a thoroughly efficient and trained bureau of lands and an experienced and effective court of land registration. To-day the inefficiency of the bureau is due, in part, to lack of trained and experienced personnel, to inefficient management and lack of funds. This has resulted in an increase of abuses by which the poor farmer and homesteader, ignorant of his rights, is forced off the land by his richer and more unscrupulous neighbor. The situation tends to breed discontent and must be corrected.

Public instruction has been retarded largely through the lack of competent teachers, especially in the number of English-speaking teachers. It is recommended that at least 1,000 English-speaking teachers be employed and liberal allowances made for transportation to and from the islands. The work of the bureau of science, probably the most important institution in the islands, attaining world-wide distinction, has suffered through lack of funds and adequate personnel. The work of this bureau is of inestimable value to the islands and to the world at large, and it is imperative, adds the report, that it be reorganized and placed on its former high basis. The excellent health service which existed before 1913 has become inert and although much of the personnel remains, it has lost its zeal and vigor. Appropriations for sanitary work are insufficient. Under economic conditions, the mission touches on matters of pertinent interest to our readers, and we reproduce this in full.

Economic Conditions

We are pleased to note and record many evidences of progressive development in the islands as indicated by the following significant figures:

The Postal Savings Bank was started in 1907, and by 1914 it had 40,000 depositors and $675,000 in deposits. In 1920 these had reached 107,000 depositors and $1,612,500 in deposits.

The law requires that 1 per cent. of the gross business done in the islands be paid to the government in the form of taxes. This business was computed to be $200,000,000 a year in 1907, when the tax was first imposed, and had increased to $325,000,000 in 1913. In 1920 it had reached the figure of $863,000,000. The number of cigars manufactured had increased from 300,000,000 to 500,000,000. The total resources of commercial banks rose from $15,000,000 in 1906 and $31,000,000 in 1913, and are now estimated to be $215,000,000; this, however, includes the impaired resources of the Philippine National Bank without reduction for losses. Money orders sold increased from $8,000,000 in 1913 to $17,000,000 in 1920, and postage receipts from $380,000 in 1913 to $780,000 in 1920. Telegraph receipts show a similar increase. The earnings of the Philippine railway have risen from $380,000 in 1913 to $750,000 in 1920, and the Manila Railroad from $2,400,000 in 1914 to $5,900,000 in 1920; this latter, however, is partially to be explained by the sharp increase in the mileage and rates.

All this development is very gratifying and shows how rapidly the Philippine people respond to improved conditions of transportation, finance, public order and markets, brought about since the American occupation. The sharpest advances have been made during the war, as was to be expected, as the Filipinos had few additional war burdens placed upon them and were able to take advantage of the great increase of prices, which brought them unexampled prosperity.

The country is suffering from the general world-wide depression at the present time; the prices of products have fallen off very sharply, but even this is less acute than in other countries.

It should be noted, however, that whatever mistakes have been made here, they have not been sufficient to arrest the steady rate of progress which these figures prove to have taken place.

Your mission has had a careful report prepared showing the gross trade of the Philippine Islands. From 1903 to 1909, the figure was about stationary. Nineteen hundred and nine was the year in which the Payne Bill was passed creating free trade between the Philippine Islands and the United States. In the first three years of free trade the trade with all countries nearly doubled. Beginning with 1916 the trade went sharply upward until in 1920 it reached the remarkable total of $300,000,000.

An analysis of the trade shows that a curve indicating the exports and imports from the United States follows almost the same lines as does that of total trade. Roughly speaking, two-thirds of the business of the country, or $200,000,000, is trade with the United States, and one-third with all other countries. The proportion of gross business done with the United States has been steadily increasing. As the trade with the United States pays no customs duties and the bulk of the increase has been in that class of trade, the result is that the total revenues of customs has shown a tendency to fall off, while the cost of collection shows a steady increase.

In case free trade were to be taken from the Philippine Islands, it is probable that the closing of the rich markets of the United States to the products of the Philippine Islands would be very sharply felt. While the Philippine government would receive customs duties on an important part of their imports that now come in duty free, it is believed that the first effect would be a very serious blow to trade. For example, in 1920 nearly $40,000,000 of sugar was exported to the United States, the duty on which would have been six or eight per cent. of its value. It is problematical how well Philippine sugar could have stood the handicap of eight per cent. added to the high cost of freight from the Philippines to the United States. The value of cigars exported to the United States was $10,500,000; the duty on these at the present rate would amount to about $30,000,000, which would practically have closed the markets of the United States to these cigars. There would have been a similar closing of the United States' markets to leaf tobacco. The collector of customs estimates that the trade which has grown up in Philippine embroidery now reaches $7,500,000 a year and would have to pay a duty of $4,500,000. As there is no other market for this product, he believes the industry would be practically ruined.

In the main, it is believed that the loss in internal revenue, were the stimulus of free trade to business removed, would be greater than would be the increased collection of customs duties. In this connection it is interesting to note that the increase in internal revenue started when free trade was given and practically offset the drop in customs receipts at the time.

Further analysis of the customs shows that the principal articles exported, measured in value, to have been copra, $5,188,014.50; hemp, in which the Philippine Islands have a virtual monopoly, $58,191,550; coconut oil, $31,664,158.50; sugar, $15,804,390; and tobacco, $13,575,313.*

Finances

In 1905, the Philippine government was put on a thorough business basis. All services rendered by one branch of the government to others were paid for, and the books were so kept that the appropriations did not include any inter-bureau or inter-governmental payments. The law has since been changed, so that the present cost of government includes items of receipts for services from other branches of the government, which makes analysis difficult and exact comparison impossible. The books are so kept that these amounts cannot be ascertained without an analysis of governmental accounts involving prohibitive expense. So that the gross figures of receipts and expense are padded on both sides by inter-governmental charges which are neither real receipts or expenditures as they are payments by the government to itself. The accounts should be so kept that these fictitious entries would be eliminated, in order to enable the officers of the government to get a true picture of government costs.

Certain figures, however, stand out so boldly that they cannot be questioned. The rate of taxation has been sharply advanced. The insular gross revenues from taxation in 1913, before the Filipinos were given virtual control of their government, were $12,500,000, as opposed to $28,000,000 in 1920, an increase of 124 per cent. Government expenditures show a still greater proportion of growth. This increase in the general cost of government has not been accompanied by a proportionate increase in efficiency; on the contrary, as has been noted elsewhere, there has been a general falling off in efficiency.

The per capita revenue from taxation has risen from $1.32 in 1913 to $2.50 in 1920. This compares with the per capita taxation of $23.78 in Great Britain (1914-1915), $9.92 in the United States (1914-1915), $5.57 in Japan (1915-1916), $17.33 in the Argentine Republic (1915), and $7.79 in Barzil (1915), from which it will be seen that the Filipino bears a smaller burden of taxation that the natives in any of the other cited countries.† One reason the burden of taxation is so light in the Philippine Islands is because the United States has borne all costs of military and naval establishments necessary for the defence of the islands, and other expenses incident to the maintenance of the sovereignty of the islands including international diplomatic and consular representation.

Of the total revenues of $40,500,000,‡ $28,000,000 is from taxation and $10,500,000 from operating income and commercial and industrial units; this does not include earnings of the railroad, which the government owns through ownership of the stock.

An analysis of revenue derived from taxation shows the receipts from internal revenues to be $18,500,000 or two-thirds of the total. This internal revenue collection is nearly four times as heavy as the collections of 1913.

The bonded debt of the Philippine Islands in 1920 was $22,000,000, for the redemption of which is laid aside nearly $5,000,000 sinking fund, so the net liability is something less than $17,500,000. A comparison with the debt of other countries demonstrates that the Philippine Islands has a smaller bonded debt than most countries. the per capita being $1.81, compared with $25 in Cuba, $237.07 in the United States, $853 in England, and $1,159 in France. The Dutch East Indies, with $1.92, is the nearest, and China next with a little less than double that of the Philippine Islands.* It will be seen that the recent act of congress increasing the authority of the Philippine Islands to borrow was highly conservative and could be safely further increased without jeopardizing the financial stability of the government. Bonds and notes of the Philippine Islands have been made exempt from federal taxation and are received on deposit as currency reserve. Although not directly guaranteed, it is understood that the credit of the United States government is behind them; this accounts for the high market value of these bonds.

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* These figures are taken from the Philippine census, and are all for 1918.

† These figures are taken from the World Almanac, 1917.

‡ The census shows "income" $49,000,000; this, however, is incorrect because analysis proves that it includes moneys from the sale of bonds.

In addition to the insular revenues, there are the provincial and municipal revenues. These are expended by the provinces and municipalities by vote of their own local authority. An examination of their accounts shows a similar expansion, the receipts and expenditures having increased about 100 per cent. in the past eight years.

The government expense and cost of materials have shown a tendency to a sharp increase. And it is to be noted that a number of new bureaus and offices have been created.

The Philippine National Bank

The story of the Philippine National Bank is one of the most unfortunate and darkest pages in Philippine history. This bank was started in 1916 and a law passed compelling all provincial and municipal governments to deposit all their funds in it; and at the same time arrangements were made to transfer from other banks all government funds there deposited, except trust funds which were held on deposit in the United States; later the bank was put into a position to get control of these moneys and reserve funds. The sum of $41,500,000, held for the conversion of currency, was transferred to the Philippine Islands, the bank making a large profit in exchange in doing so. Much of it was then loaned out to speculative concerns under circumstances which have led to grave doubt as to the good faith of the transactions.

A man presumed to be experienced in banking was brought from the United States and took the first presidency which he held a short time. An American inexperienced in banking was then put in charge, and upon his death a Filipino also without banking experience became president. The result of all this has been a series of banking losses estimated by the insular auditor to reach the severe total of $22,500,000. A partner of Messrs. Haskins and Sells, certified public accountants of New York, after a careful examination of the bank, makes the following comment:—

> Our examination thus reveals the fact that the bank has been operated during almost the entire period of its existence prior to the appointment of Mr. Wilson as manager in violation of every principle which prudence, intelligence, or even honesty, dictate.

As a result of these findings, charges have been filed against General Concepcion, a former president of the bank.

The government became alarmed at the seriousness of the situation and secured the services of an experienced banking man from the United States, under whose conservative guidance the affairs of the bank are in a fair way to be put on a sound footing. But a large part of the assets of the bank have been loaned to concerns which will be unable to repay for many years—very largely in sugar centrals and coconut oil factories. These loans were made in excessive amounts during the period of boom prices; and minimum precaution in regard to security was taken, with the result that the bank has allowed its reserves to run down much lower than required by law, is unable to meet its current obligations, has had to ask other banks not to press for the redemption of its notes, and has further had to ask time for the payment of its obligations to many banks in Shanghai representing many countries, to whom it owes large sums of money as a result of losses incurred in speculation in exchange transactions.

The bank also established branches and agencies throughout the Philippine Islands, in charge of which they placed untrained Filipinos, and without exception these branches have been mismanaged. Of the four branches in which the examinations have been completed criminal charges have been preferred against the managers of each one.

These losses have seriously involved the Philippine government, and the fact that it has not been able to meet its obligations has seriously impaired its credit. We have been informed by representatives of banks in North Borneo and Japan that they have received instructions not to honor the notes or drafts of the Philippine National Bank.

The currency resources have been depleted, the silver on deposit to redeem the currency has been pledged and used for other purposes. The fund for the maintenance of the parity of gold and silver is involved in these losses, with the result that instead of a metallic and cash basis for the currency, its principal support now is the pledge of the Philippine government and the confidence on the part of the public that the United States will not permit these things to happen again. The currency is now practically a fiat currency.

In view of good earnings, moderate expenses, inherent wealth, a small public debt, and backed by the credit of the United States, the problem of rehabilitating the credit of the Philippine Islands should be an easy one. The lesson has been a bitter one for the Filipinos and the gravity of the mistake is generally appreciated.

One of the functions of the National Bank was to manage government exchange. Having transferred all the funds usually available for exchange to Manila, and then loaned the money in such a way that it could not be recovered, the government had to discontinue selling exchange. The rates ran up as high as 15 per cent., which was equivalent to a depreciation of the Philippine currency to almost that amount, which resulted in great hardship to the inhabitants of the Philippine Islands, especially those engaged in business.

The Philippine Islands, contrary to general belief, have maintained all of the expenses of civil administration since the beginning of American occupation from insular revenues and without assistance from the treasury of the United States, which has, however, defrayed all the costs of the military and naval establishments and fortifications. The only aid received by the Philippine government from the United States has been a $3,000,000 appropriation for famine relief made in 1903.

Public Works

In the matter of public works, your mission has to report both favorably and unfavorably.

The government and people of the islands realize the value and necessity of public works and large appropriations from current revenues have been made annually for such objects as the construction of roads, bridges, irrigation systems, school houses, markets, port works and artesian wells among others. We find, however, an undue increase in the cost of public works, due in many instances to construction by administration instead of by contract; this has necessitated the purchase of an equipment ordinarily furnished by contractors. There has also been a deterioration in the quality of the work performed in this service. We find also a lack of competent supervision.

On the other hand, there has been a great deal of excellent work done. The director, a Filipino, is a man of unusual capacity and foresight, and he impressed the members of the mission most favorably.

An important proportion of all revenues of the government is allocated to public works. And in the opinion of this mission this proportion should be increased.

In the last three years there has been a notable progress in construction of irrigation systems. Sixteen projects have been undertaken, involving an expenditure of $4,640,158. Many more projects are under consideration and are awaiting the availability

(Continued on page 825)

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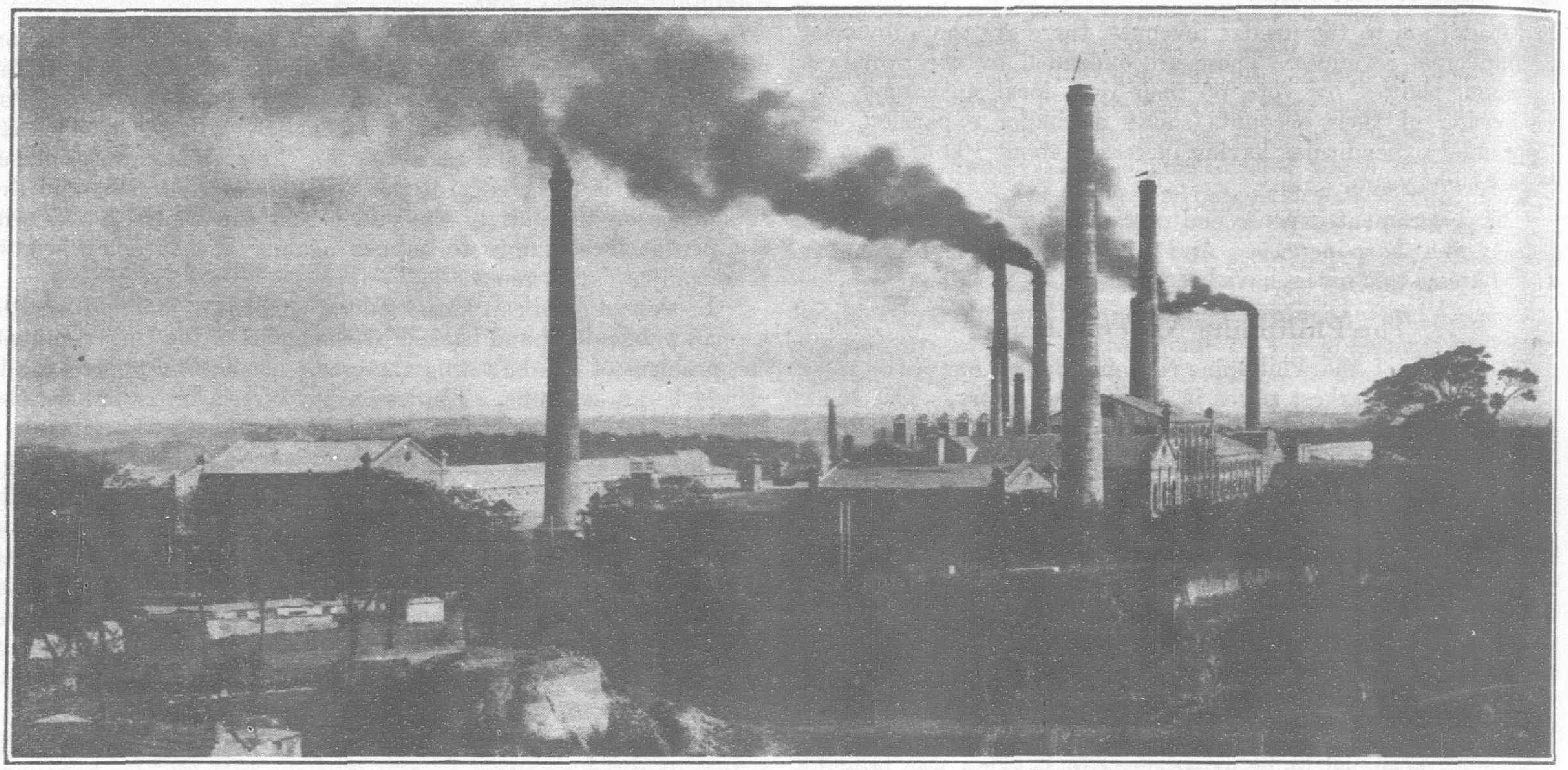
* These figures are taken from the World Almanac, 1917.

The New Plant of the Chee Hsin Cement Co., Ltd.

By G. A. BOOTH



General View of the Chee Hsin Cement Works at Tangshan

AN object lesson in that progressive spirit which is becoming more and more necessary in order to insure industrial success in China, is furnished by the manner in which the Chee Hsin Cement Co. has nearly completed a new cement plant project of considerable magnitude in Tangshan. In spite of any business depressions which have existed, or are supposed to have existed this company has kept its faith in China's ultimate prosperity. They have not only erected a new cement plant which will more than double their present output, but have spared neither pains nor expense in equiping this plant in the most modern manner with the newest and best types of machinery.

The total yearly output of the present plants is 700,000 barrels of cement. The new plant will increase this by 1,000,000 barrels, making a total production of 1,700,000 barrels yearly. Construction work was started on the new plant in April of this year and the buildings were completed in four months. Due to delays in shipment of machinery, however, it is expected that the new plant will not be in operation until the latter part of December or the 1st of January. The process employed and the plant throughout is especially designed by the well-known cement work designers Messrs. F. L. Smidth & Co., Copenhagen and New York, and embodies the most up-to-date methods and equipment.

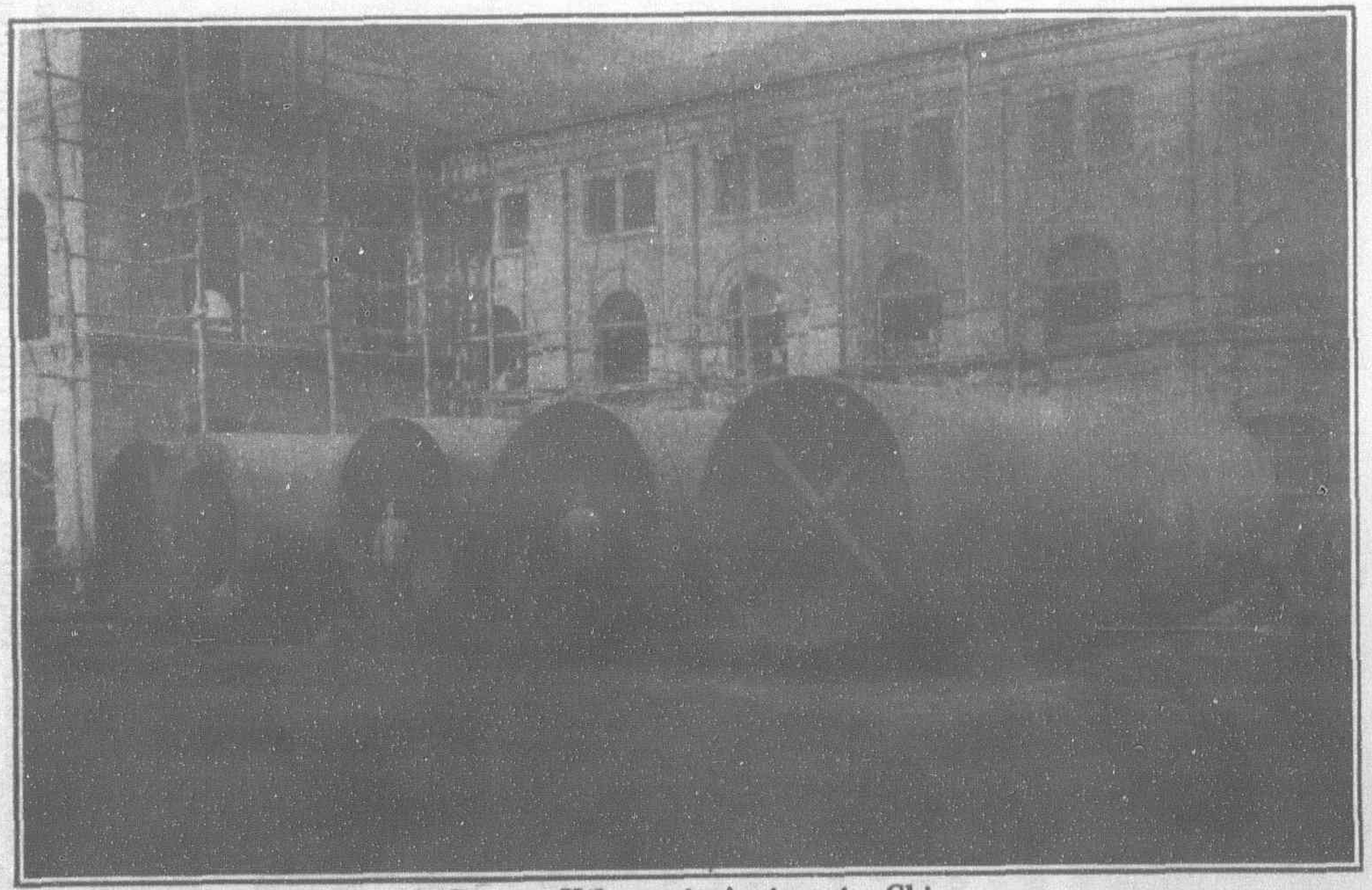
The raw materials mill and the finishing mill are the largest of the new buildings. They have floor areas, respectively, of 36,000 and 4,350 sq. ft., and average 65-ft. in height. Both are of fireproof construction, being built entirely of reinforced concrete and brick, with corrugated iron roofs on steel trusses. In their construction were used 2,700 tons of cement, 9,000 tons of sand, 13,500 tons of gravel, 300 tons of reinforcing steel, 3,000,000 bricks and 150,000 fire bricks. About 850,000 board feet of lumber was used for framing and cement form work, and 20,000 cubic yards of earth was excavated for foundations. Fig. 1 shows a general view of the Tangshan works, and Fig. 2 is a closer view of the raw materials mill and kiln house.

In laying out the new plant a unit system was followed, so that not only can the new plant be operated in conjunction with the old plants in practically every department, but new units can easily be added at any time, should the condition of the market justify a still further increased output of cement.

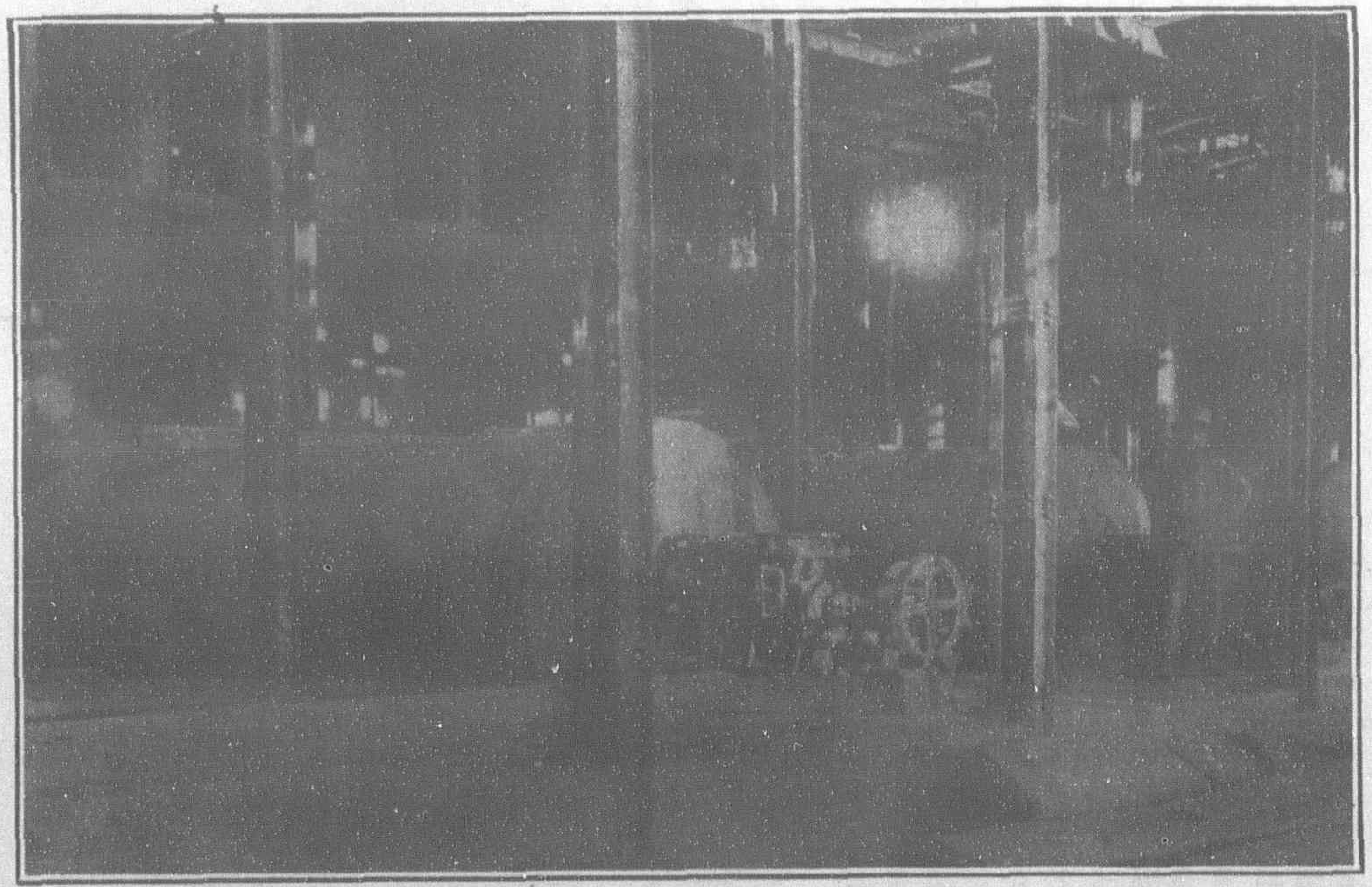
All of the machinery in the new plant will be driven by electric motors. This feature, while not exactly an innovation, represents the most recent practice, and is a method which even some extensive foreign plants have not as yet adopted, steam engine drive still being used for some of the apparatus. Many of the machines are extremely heavy and require a large amount of power to start them moving from rest, and some of the heaviest parts revolve at very slow speeds. To drive such a load without using a large number of gear reductions or belts requires motors which are of unusual type and are expensive, and these have been used only in the most up to date plants.

For the new plant alone there are over 3,000-h.p. of motors. Some of these are quite large, there being five of 300-h.p., two of 200-h.p. and six of 100-h.p. for driving the larger machines. The remainder are in units of from 25 to 50-h.p. each and are used for driving conveyors, fans, elevators, etc. All motors are of 3-phase, 25-cycle, alternating current type, the small ones operating at 220 volts and the large ones at 2,200 volts. The latter voltage is considered somewhat high for factory motors, but great care has been taken in their installation and no difficulty is anticipated on this score. Current is distributed to the high voltage motors by paper insulated, lead covered, steel armored cables laid underground in brick ducts or in steel conduit, and by rubber covered cables to the low voltage motors. Ample electrical pro-

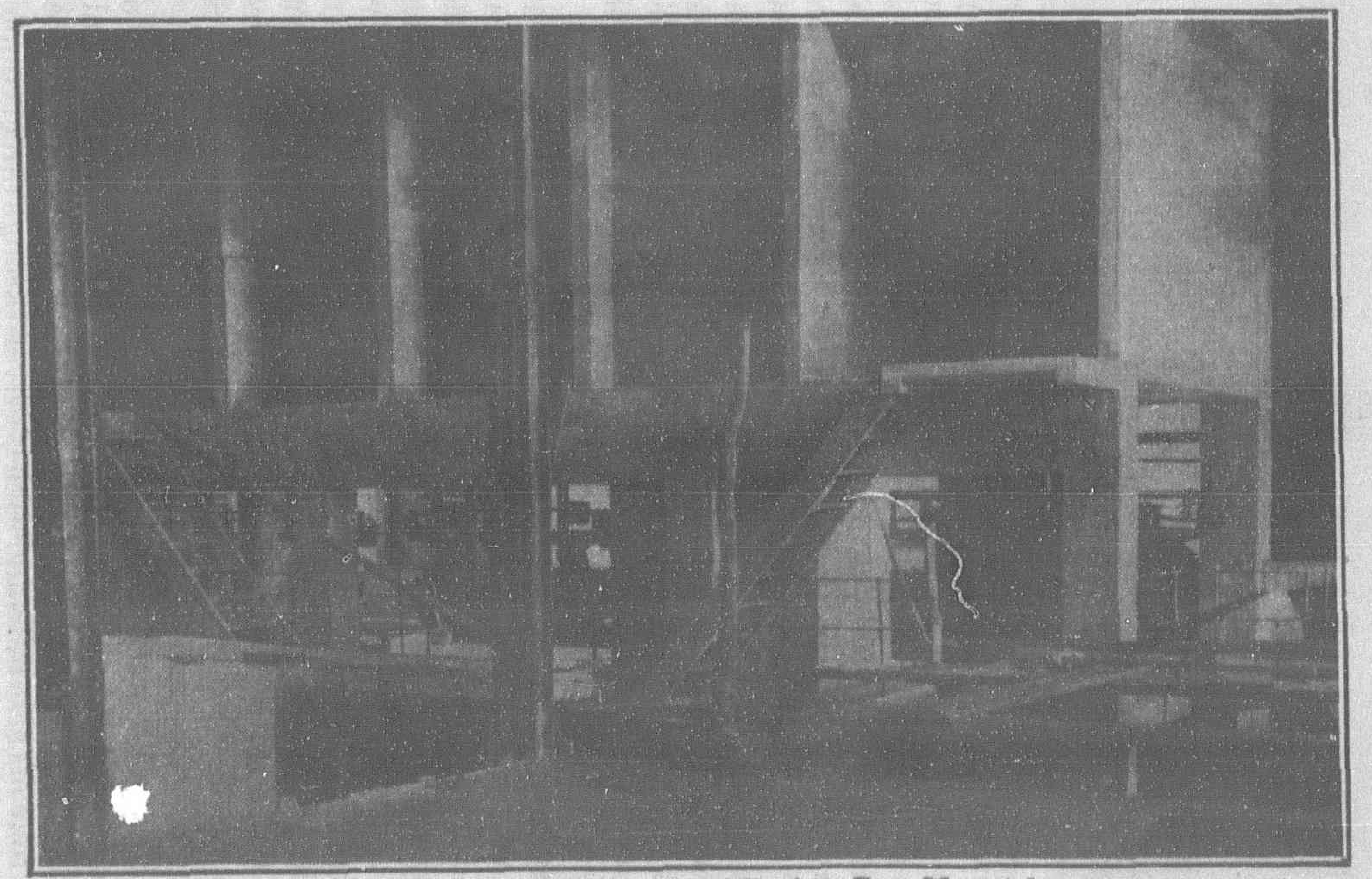
NEW TANGSHAN PLANT OF THE CHEE HSIN CEMENT CO., LTD.



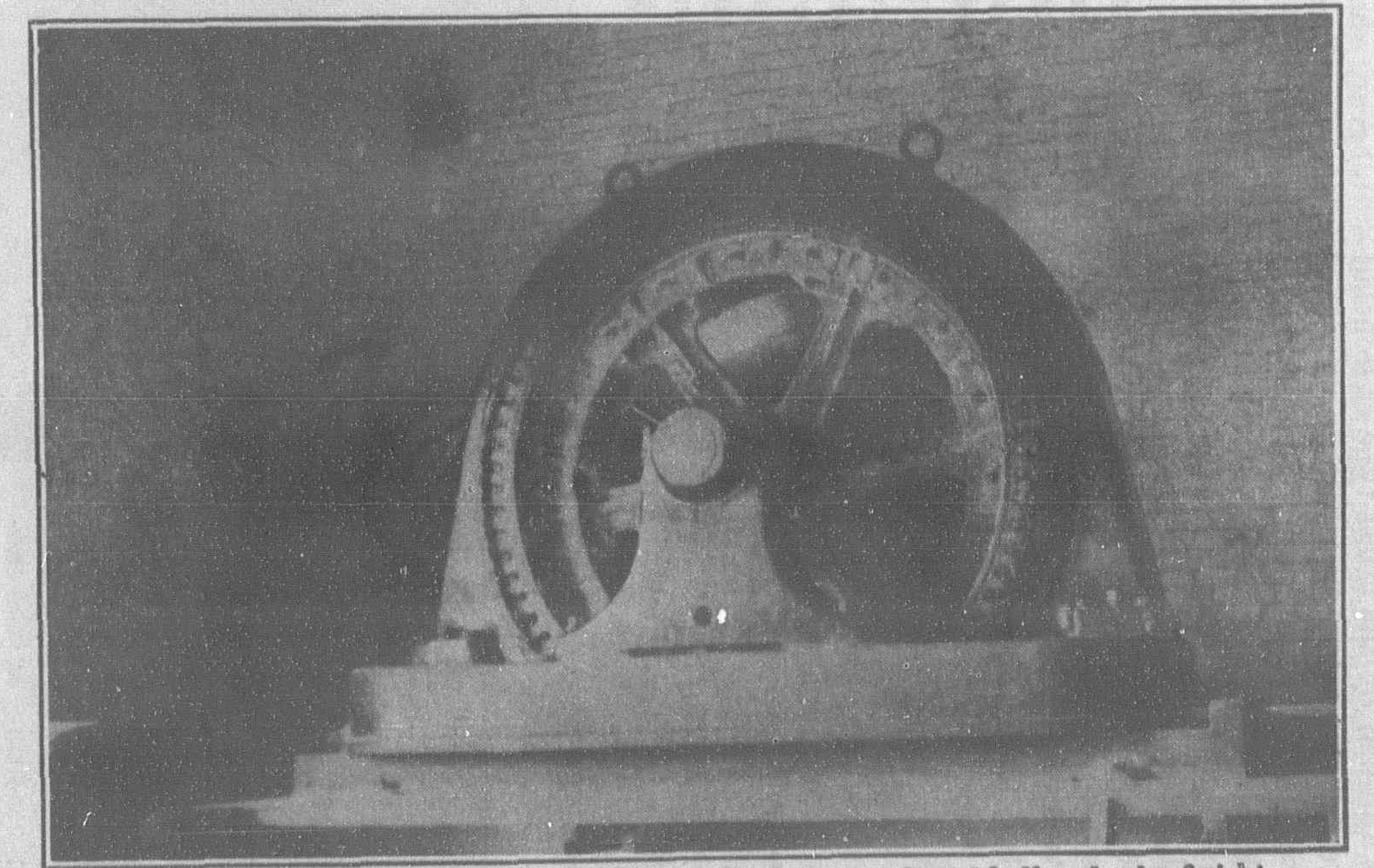
A Rotary Kiln as it Arrives in China



Tube Mills for Crushing Raw Materials

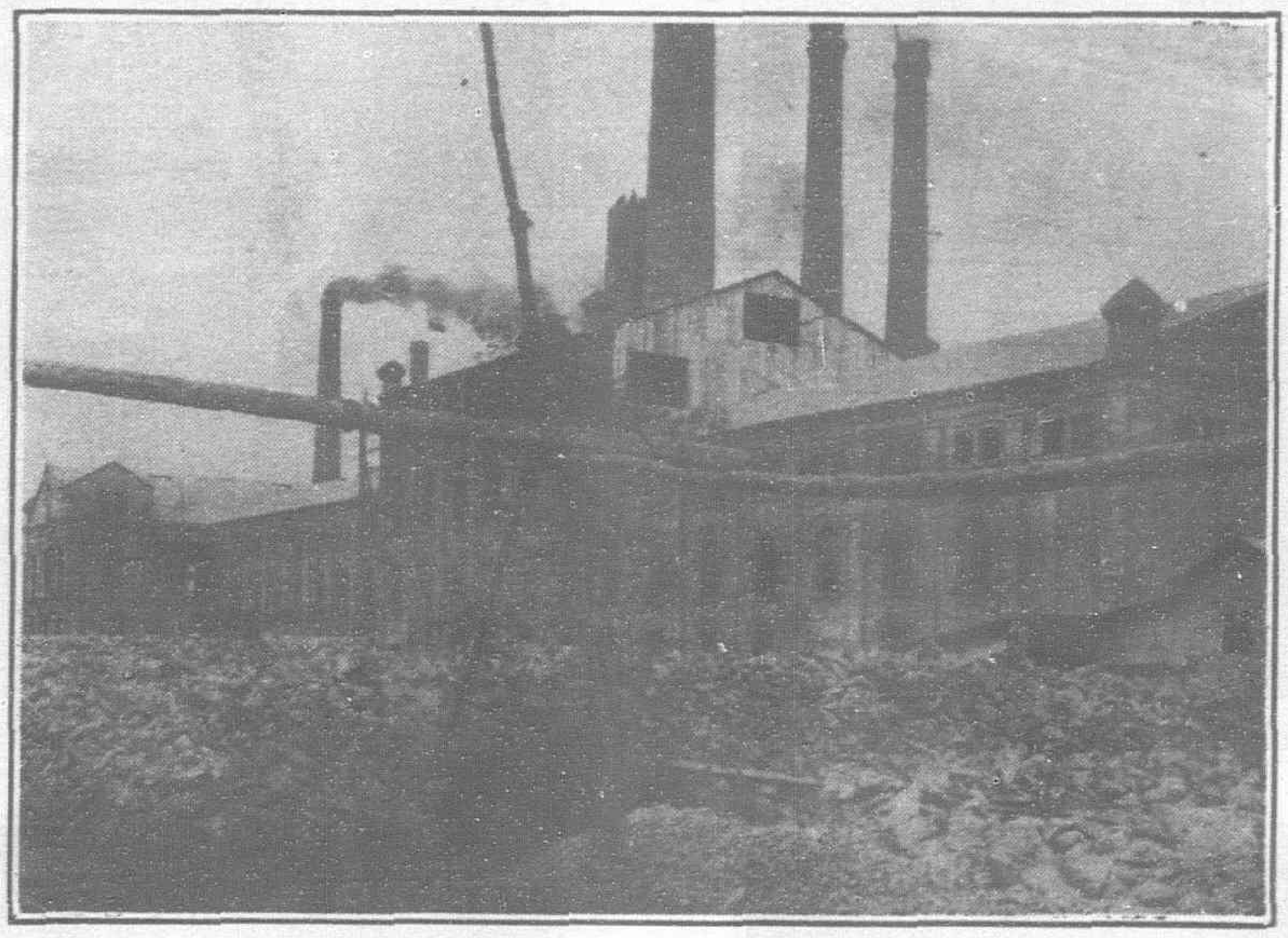


Concrete Bins for Storage of Broken Raw Materials, with Feeding Tables in Background



A 300 H.P., slow speed, direct coupled motor, driving a combined ball and tube finishing mill. The motor is in a separate room with shaft extending through a hole in the wall. This keeps the windings and bearings free from dust tection is afforded by the latest type of ironclad switchgear, which also prevents personal contact with any high voltage parts. Small transformers in the plant supply the 220-volt, 3-phase power for small motors, and 110-volt, single-phase for lighting. Only general lighting is required and high candle-power incandescent gas filled lamps will be used.

In order to insure reliable and uninterrupted electric service, power for the new cement plant will be supplied from the Kailan Mining Administration's steam turbine plants. As this power is generated at 25 cycles, all of the motors in the new plant are built for that frequency. An outdoor type substation of about 4,000 K.V.A. capacity will be erected at the cement plant to transform the K. M. A. voltage of 30,000 to 2,200 volts for distribution to the motors, but until this apparatus arrives, power for the new motors will be supplied, partly by a smaller temporary outdoor substation, and partly by a 1,500 K.V.A. steam turbo-generator which has recently been installed in the cement company's steam plant. This steam plant supplies power at 50 cycles for the old cement plant motors. The equipment consists mainly of a 1,250 K.V.A., 3,000-volt, 50-cycle, 3-phase, A.C. generator, driven by a 1,500-h.p. horizontal compound steam engine. Boilers are equipped with superheaters, and jet condensers are used, cooling water being obtained from a nearby river.



Raw Mill and Kiln Houses

Ultimately the whole steam plant will be discarded, and the power for the old cement plant will also be supplied by the K. M. A., through the large outdoor substation above mentioned.

As an example of the modern methods used here, a 700 K.V.A. synchronous condenser has been purchased for the purpose of raising the power factor of the load in the old cement plant. When this is in operation, not only is the power factor raised from .80 to .95, but an additional 200 K.V.A. can be supplied by the generator without increased heating.

The raw materials used here in the manufacture of cement are limestone and clay and a practically unlimited supply of both exists on the company's properties at Tangshan. The top soil furnishes most of the clay needed and underneath this is found the limestone which is mined by drilling and blasting with black powder. The drilling is done partly by hand and partly by air drills supplied from an electrically driven compressor plant. A motor driven winch hauls the material to a high point of ground and from here it is taken, by gravity, in steel dump cars on narrow guage tracks, down a long slight grade to the top of the crushing plant. Here the limestone is broken up by gyratory rock crushers, and the clay by roller crushers.

Dump cars now carry the broken material to the raw mill building, and bucket elevators lift to bins at the top of the building, separate bins being provided for limestone and clay. From these it falls by gravity to horizontal revolving feeding tables. There are eight of these tables, four for limestone and four for clay. Two tables, one of each type, feed to ball mills where the first mixing and grinding is accomplished. By varying the speed of the feeding tables the amount of material leaving each table may be altered, thus varying the proportions of the mixture. Fig. 3 shows the reinforced concrete bins and feeding tables.

The ball mills are heavy boiler plate cylinders revolving on a horizontal axis. Each one contains about 8,800-lb. of steel balls which, as the mill revolves, grind the mixture into a fine powder. There are four of these mills and each is driven through direct coupled gearing by a 100-h.p., slow speed motor, which also drives one pair of feeding tables through veriable speed reduction. From the ball mills the material passes on to a final grinding in three tube mills. These are shown partly assembled in Fig. 4. They are similar to the ball mills in principle and operation but are much larger and heavier. Each mill contains about 20 tons of grinding bodies, small steel balls and cylinders, and each is driven by a 300-h.p. slow speed, direct coupled motor. With their motors, three of these tube mills mounted side by side are so heavy that they require very heavy concrete foundations.

During the whole grinding process, automatically driven samplers have been taking samples of the material. These are continually analyzed in order to maintain the proper proportions of ingredients and so insure a high and even quality of product.

In order to make cement as we know it, the materials, which up to this point are merely ground and intimately mixed together, must be calcined, or burned. This is accomplished in the kilns, of which there are two in the new plant. They are immense hollow steel cylinders over 200-ft. long, and 11-ft. in diameter, lined with fire brick. Fig. 5, showing one kiln, illustrates the manner in which they must be shipped in sections and riveted together at the plant. Set on a slight slope, on end being 7-ft. higher than the other, and supported at four points in their length by rollers, they revolve at about one revolution per minute. A temperature of about 1,500° C. is maintained in the kiln by burning powdered coal, which is blown in through a pipe at one end and ignited just as though it were a jet of oil or gas. A tall smokestack at the high end furnishes a natural draft which draws the hot gasses through the kiln. The building of these stacks was a nice piece of construction. Inasmuch as they are 200-ft. high, 16-ft. outside diameter at the base and 9.5-ft. at the top, the building of the first one in six weeks and the completing of the second in four weeks may constitute a record of its kind in China.

The raw material from the tube mills passes through an elaborate system of conveying, mixing and storing devices, and is finally fed in at the upper end of the kiln through which it slowly passes. It takes about two hours for any particle of cement to pass through, during which time it is thoroughly burned, coming out of the lower end of the kiln as "clinker." In this condition it is in small lumps and requires to be pulverized to become commercial cement. First, however, the clinker must be cooled, so it is passed through another much smaller revolving drum through which air is being forced. In cooling the clinker the air is heated to about 400° C. This hot air is of value, part of it being used to dry the coal fuel, and part being injected into the kiln to furnish air for the combustion of the powdered coal. This is an economy which well repays the cost of its accomplishment, as in this way is avoided the loss of heat incident to raising cold air to the temperature of combustion in the kiln. Each kiln is driven by a 100-h.p. direct coupled motor, which also drives the fan which forces air through the clinker cooler. Although much larger than the tube mills, the kilns require much less power to drive them as they revolve so slowly.

The great length of these kilns is a feature upon which depends in great measure the whole economy of this part of the process. A careful balance must be maintained between the time which the cement remains in the kiln, the temperature of the exit gasses or products of combustion, the amount of hot air needed for combustion and the amount required for drying the fuel. The proper proportioning of these factors has led to greater and greater lengths, until the economic limit has been reached in these kilns, a careful analysis showing that any further increase in length will result in a decreasing economy.

The pulverizing of the coal fuel is a separate process and is of interest in that this is one of the most economical known methods of firing. This department is equipped with drying, crushing and pulverizing machines very similar to those performing the same functions in the cement plant.

Slack coal is used and is purchased from the K.M.A. mines at Tangshan. Although of quality not well adapted for use under most boilers or for household use, it runs fairly high in calorific value, so that by using it in the powdered form it gives as good results as much more expensive coal. It is first passed through roller crushers, and then through the drying drums below the cement kilns. When quite dry it is reduced to an exceedingly fine powder in the pulverizing mills. There are three of these machines which are similar to the combined ball and tube cement finishing mills. They are 30-ft. long and 6-ft. in diameter, and each contains 11 tons of grinding bodies.

It is dangerous to store a large quantity of powdered coal as it has a tendency to explode, so it is pulverized only as needed and at the same rate that it is used. The nozzle for burning the coal dust is merely an iron pipe, projecting into one end of the kiln. The dust is forced into this pipe, by a worm screw feed, a short distance back from the end and blown through the nozzle at high speed by compressed air.

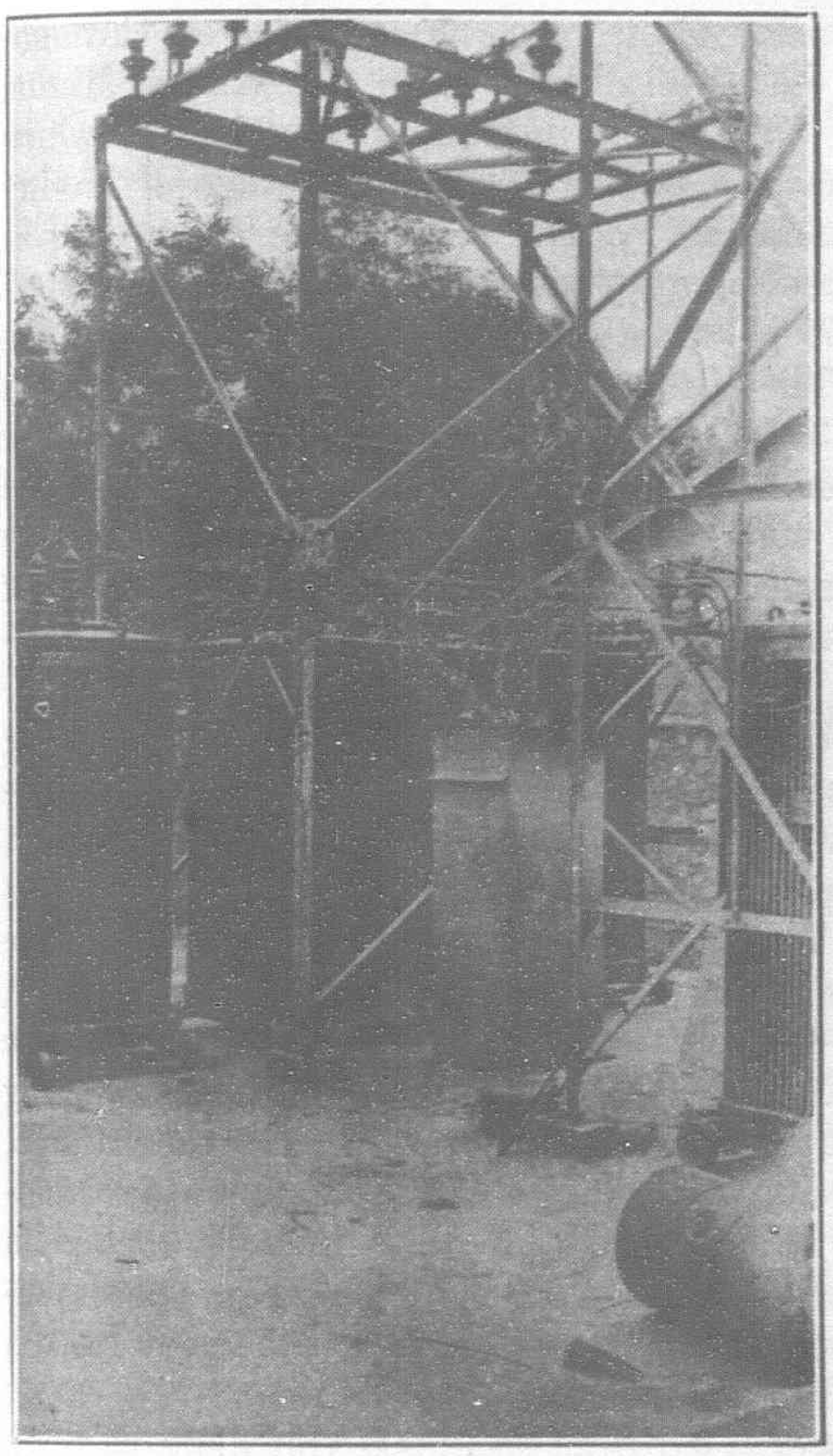
After the clinker has been cooled it is taken to the clinker sheds where it is merely piled up and allowed to stand for some time. While not absolutely necessary, it is the practice here to allow the clinker to age for about six weeks. For one thing this provides a six weeks' storage which can be heavily drawn upon in case of rush orders, and also provides a means for allowing the finishing mills to operate continuously in case of a shut down of any part of the raw materials mills.

In the finishing mill there is but one operation necessary. The clinker is passed through compound ball and tube mills. These are the latest type of finishing pulverizing machines, and consist of a tube mill and a ball mill combined in one cylinder containing about 25 tons of various grinding balls and cylinders. Three of these mills are each driven by a 300-h.p. direct coupled motor (Fig. 6.). As it comes from these mills the pulverized cement is of such fineness that all but about 12 per cent. of any mass will pass through a No. 180 sieve. This is a sieve made of very fine brass wire, having 180 meshes to the lineal inch, or about 38,000 holes to the square inch.

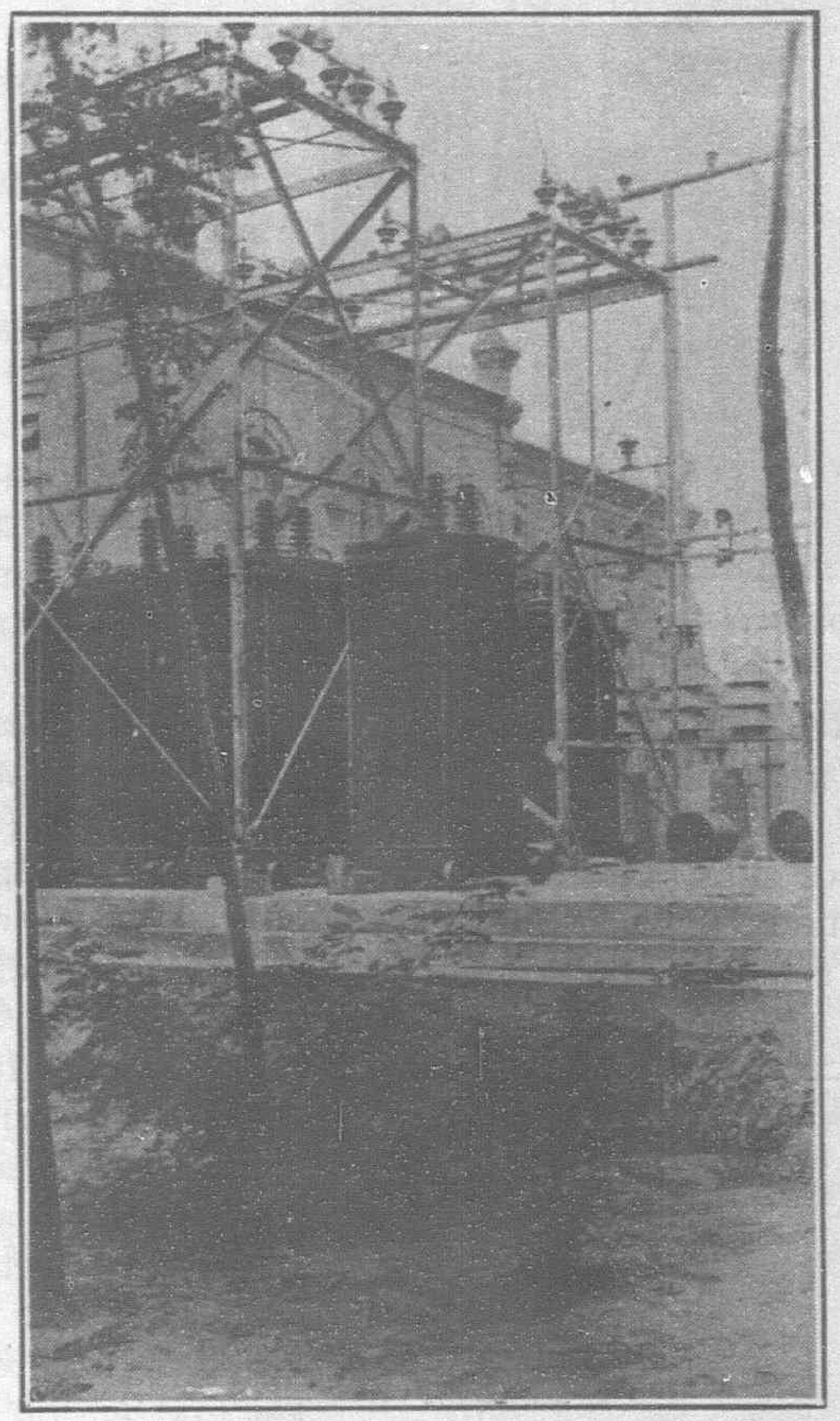
The cement is now weighed. It is taken by conveyors to scale hoppers which gradually fill until they contain exactly one barrel, or 375-lb. This charge is then automatically registered and discharged onto a traveling belt which conveys it to the stock silos. Three huge concrete silos, 56-ft. high by 52-ft. diameter, provide storage space for 60,000 barrels of finished stock. Projecting through the concrete floor of each silo into the space below are 13 spouts. A barrel is placed on a packing machine with automatic scale below a spout and cement falls into it until it contains exactly 375-lb. when a valve in the spout is automatically closed. The head is then nailed into the barrel and the cement is ready for shipment.

Filling, handling and shipping 5,000 barrels of cement every day is in itself no mean industry, as it entails the making of all of the containers used. Most of these are wooden barrels, but some iron drums are necessary for distant shipments, and some bags are used for local requirements. Side tracks from the Peking-Mukden Railway run alongside the stock houses, and when in full operation, an average of 45 loaded cars must leave the plant every day. A short run to Chinwangtao allows easy loading for ocean shipment to any part of the world. Although considerable shipments have been made to the Philippines, Java, etc., most of the cement is sold in the Chinese markets, and the company is optomistic as to the ability of China to absorb their increased output.

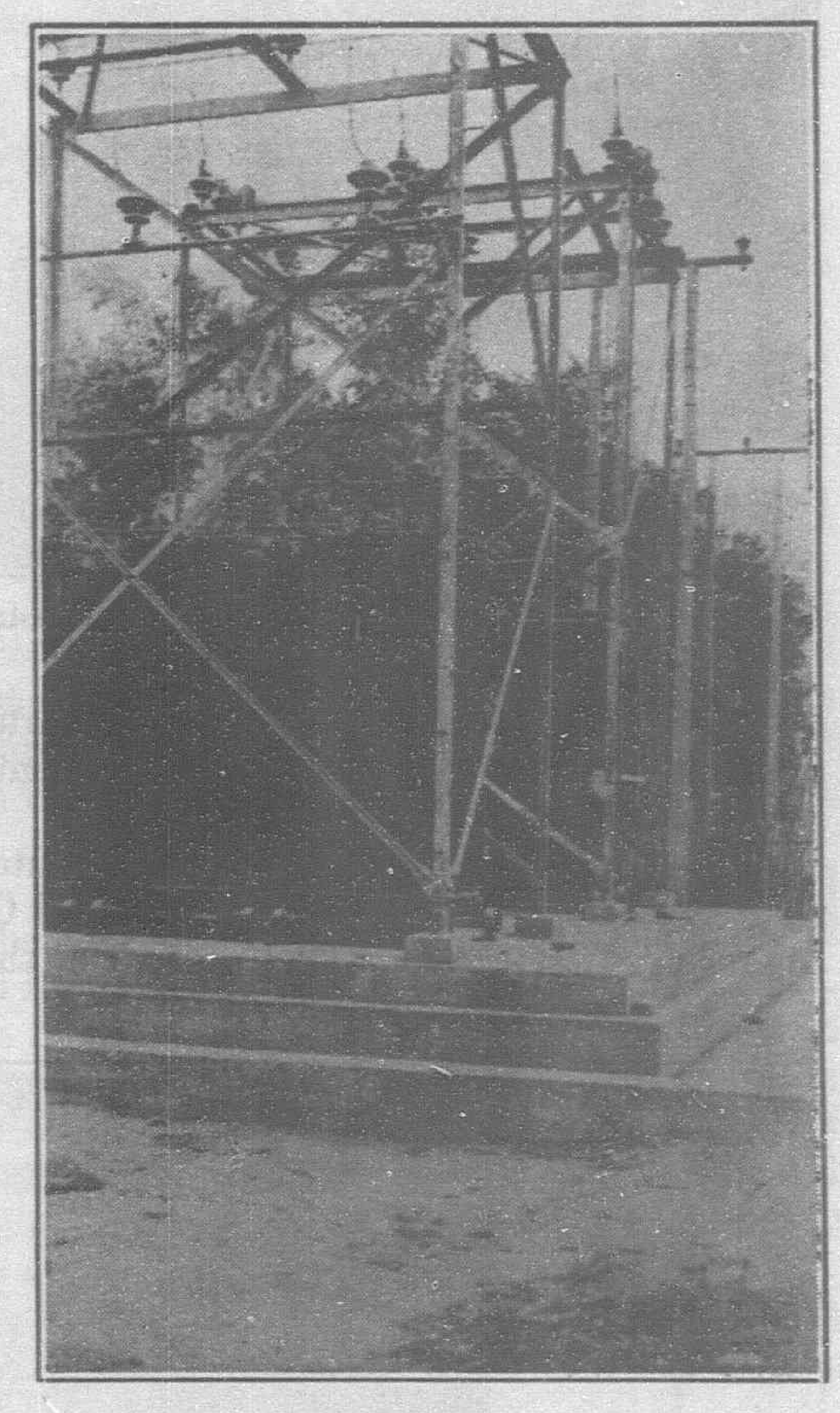
The Chee Hsin Cement Co. has at present a pay-roll of about 2,000 men, 700 of whom are at present engaged in the construction of the new plant. This number will be considerably increased upon the starting of the new plant in December or January. There have been



One 1000 K.V.A. Transformer Bank, Showing Spare Transformer and Low Tension Switch House

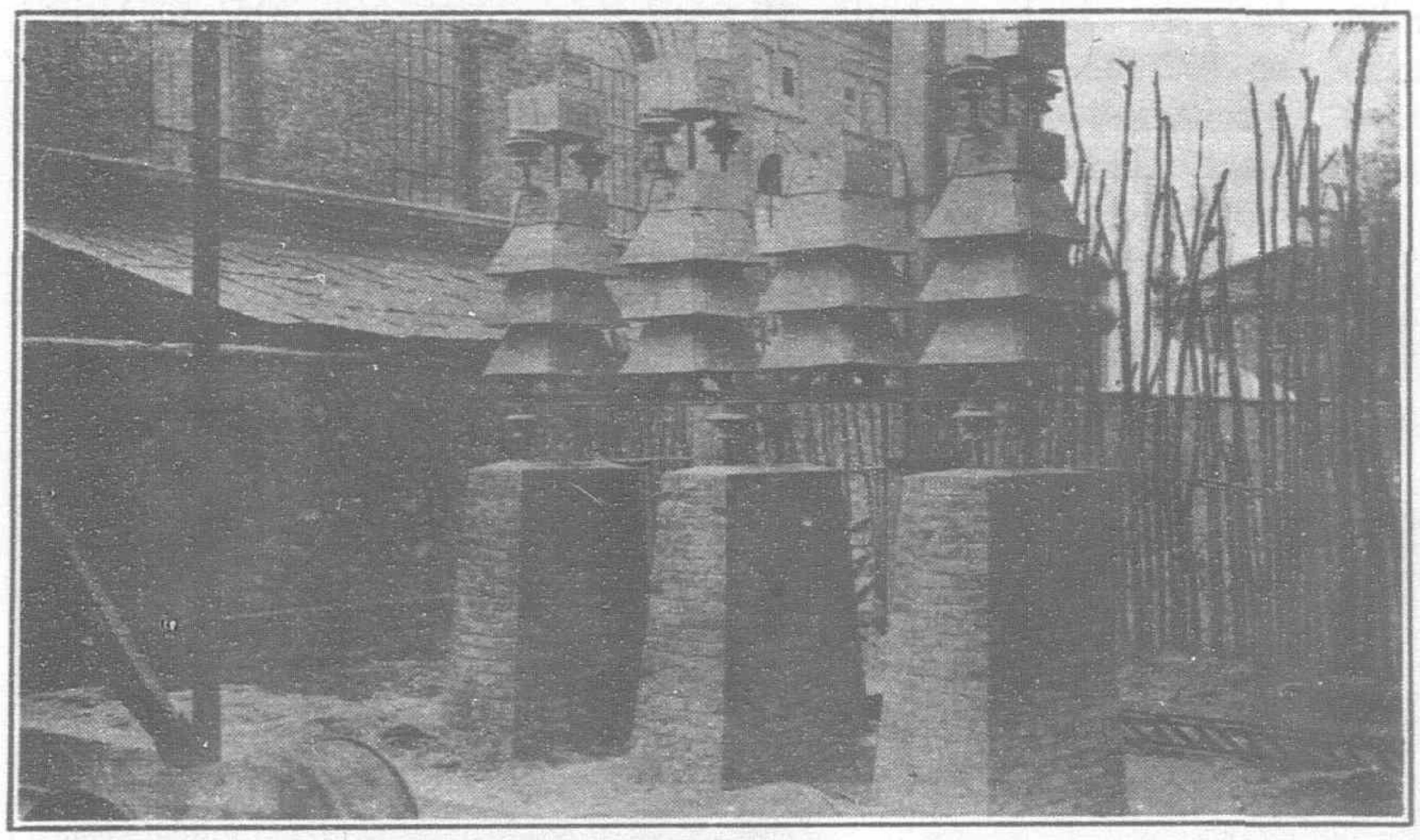


Complete Station, Showing Location of 37,000 volt Lightning Arrester



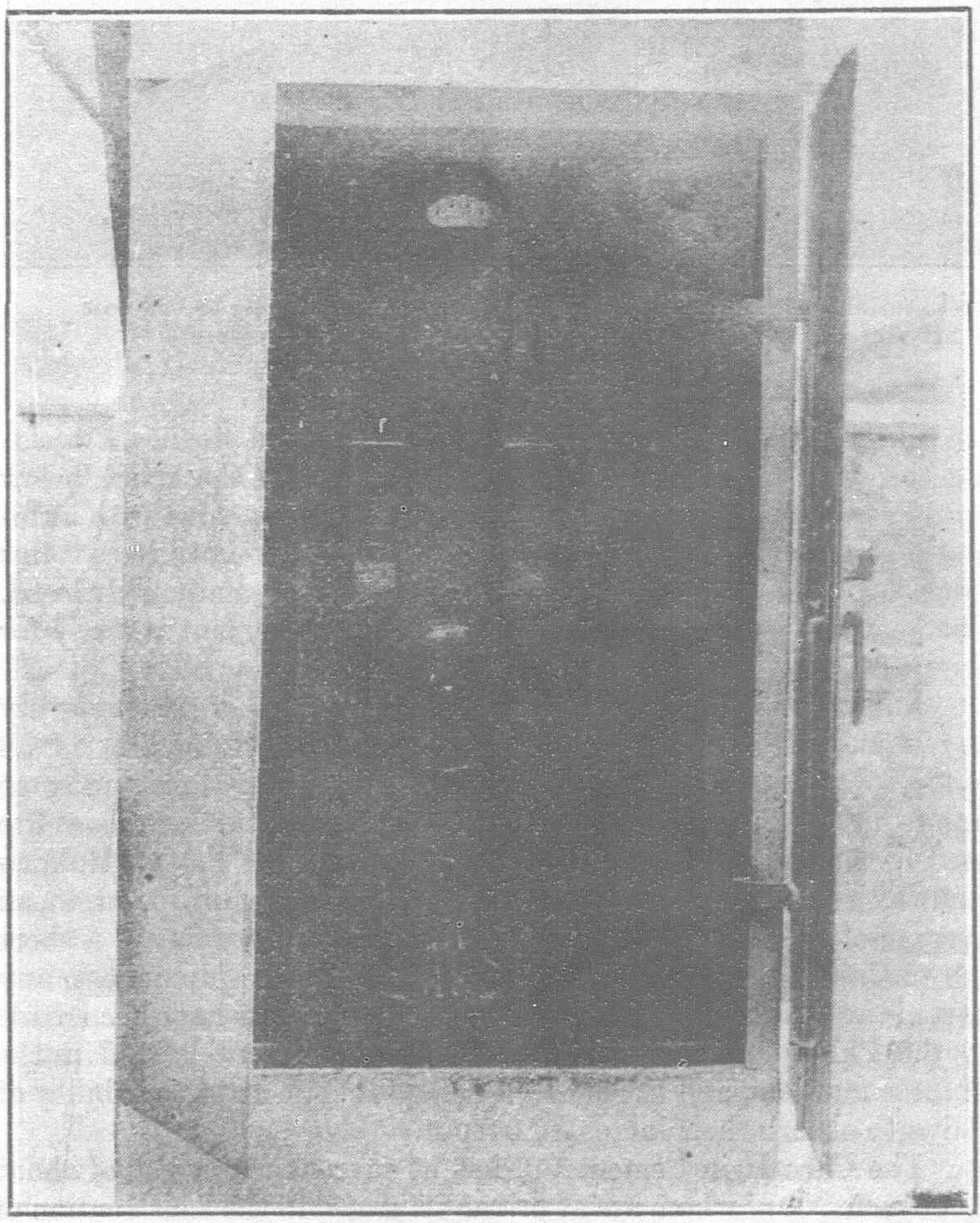
Complete Station, Showing 30,000 volt Transmission Towers almost no labor troubles in the history of this company, and the only strike which they ever have had was not of general nature and failed on the same day it started.

It would be difficult to imagine a cement plant with more favorable location in respect of natural advantages than this company enjoys. An unlimited supply of raw materials is directly at hand; coal is purchased practically at the mine shaft, insuring the lowest cost of fuel and generated power; power is also purchased from the K. M. A. which operates one of the largest generating systems in China, thus insuring an uninterrupted supply; shipping facilities both by rail and water are excellent; and, finally, labor is plentiful and cheap.



37,000 Volt Oxide Film Lightning Arrester

Some of the motors and all of the outdoor substation equipment are being built by the International General Electric Co. of America. Most of the motors and all of the cement making machinery are being built and supplied by the F. L. Smidth & Co., of Copenhagen and New York, this company having previously supplied all of the machinery for the present cement plants.



Interior of Low Tension Switch House

Outdoor Substation of the Chee Hsin Cement Company, Ltd., Tongshan

By Graham Kearney, B.Sc.

One of the most interesting electrical developments in China, in point of novelty and utility, is now almost completed at the plant of the Chee Hsin Cement Company, Ltd., at Tongshan.

The new cement plant is electrically driven throughout, the current being purchased from the Kailan Mining Administration. One of the most important factors which led to the purchase of power was the advantage of having an extensive generating system as a source of supply, as against an isolated plant, thus giving practically complete insurance against possible shut-downs from failure of the power supply. The Kailan Mining Administration furnish power from the 30,000-volt transmission line joining their generating stations at Linsi and Tongshan; power is stepped down to 2,200 volts, the operating voltage, through an outdoor transformer and switching station, consisting of two duplicate transformer and switching units of 1,000-KVA each.

Each unit consists essentially of a high-tension steel switching tower, underneath which is set a bank of three single-phase 333-KVA, 30,000-volt (star) primary, 2,200-volt (delta) secondary, 25-cycle, self-cooled, outdoor type transformers, and a 2,200-volt steel switching house. The high-tension switching and protective devices, one of which is mounted on top of each switching tower, consist each of a 35,000-volt combined disconnecting switch, choke coil, and expulsion fuse. The three elements of the disconnecting switch are operated simultaneously by means of a special mechanism, which permits of their being opened or closed by an operator standing on the ground, and so arranged that they may be locked in either position. With the disconnecting switches open, the expulsion fuses are easily reached for inspection or replacement from a wooden platform extending along the side of the tower.

The low-tension power is led from the 2,200-volt delta through special roof entrance bushings into the steel switching house; each switching house contains a standard unit slate panel, on which are mounted an automatic oil circuit breaker and a poly-phase watt-hour meter, with the necessary relays and potential and current transformers. The switch house is designed with weatherproof doors in front, which are opened for switching and metering operations, and a removeable panel at the back, for inspection and repairs. Doors and panels are provided with locking devices. The two substation units are set face to face on a concrete slab, alongside of which is built a depressed track running to the works. All of the transformers are mounted on wheels, so that in case of trouble any transformer can be quickly run on to a specially designed truck, and transferred to the shops for inspection or repairs. One spare transformer, which can be used in either unit, is kept standing by in such a position that it can quickly be run in on its own wheels to replace any one of the transformers in case of break-down.

The high-tension disconnecting switches are connected directly to the transmission line, but further protection is afforded by a disconnecting switch placed on the nearest transmission tower on each side of the substation. The transmission system from Linsi to Tongshan consists of two lines, forming a loop, so that in case of failure of either line one of the disconnecting switches in the line can be opened, and power fed through the other one only.

Protection from lightning and surges is given by a 37,000-volt oxide film lightning arrester, which again is the first of its type to be installed in China, and represents the latest development in lightning protective equipment. This arrester is admirably suited to outdoor installations, and while it gives protection of the highest order, is not affected by climatic conditions, and requires no attention other than an occasional inspection.

The above-mentioned generating and transforming equipments are, however, still inadequate for the company's immediate power requirements, so to tide them over until the final installation is completed, the company have purchased a complete 1,500-KVA steam turbo-generator plant, which is now in course of erection. This, together with the original steam power plant, will eventually be replaced by an additional outdoor substation unit of approximately 4,000-KVA, which is now on order.

This unit will, in general, be similar to the present unit but on account of the increased capacity an automatic outdoor type 30,000-volt oil circuit breaker will be used instead of the expulsion fuses as used in the smaller units. Also, on account of the necessity of distributing the power through several feeders, one of which will feed the new Wah Sing Cotton Mill, now under construction, the 2,200-volt switching and metering equipment will be somewhat more elaborate, and will be housed in a simple brick structure close to the transformers. The leads for the transfer of power from the 2,200-volt delta to the switchboard bus bar will be placed underground.

All of the outdoor substation equipment is designed and built by the International General Electric Company, Inc., Schenectady, U.S.A., and furnished through their Agents—Messrs. Andersen, Meyer & Company, Ltd., Tientsin.

The Manila Commercial and Industrial Fair

THE Manila carnival, scheduled to take place on February 4th next, will have as its chief attraction a commercial and industrial fair to emphasize trade promotion with the other countries of the Far East. The Manila carnival has been a great annual event in the Orient for fourteen years. The daily attendance has averaged over 50,000 and visitors come from all the islands and neighboring countries. This year, the Manila business men intend to combine practical methods with pleasure and want to tell their neighbors more about the production and purchasing possibilities of the Philippines and establish better trade relations. They ask the manufacturers of China, Japan and other Eastern Asian countries, to come along with their exhibits and their order books. If they already have stocks in Manila, they say, "instruct your distributor to make a display of your goods at the carnival, or, if you have no selling connections, send an exhibit and authorize the secretary of the carnival to arrange for its display. Business awaits the far-sighted manufacturer in China and Japan who will seek an outlet in the Philippines with their 20,000,000 purchasers.

Information for Exhibitors

Approaching the main exhibition building from the grand concourse, there are on both sides thirty exhibition sites (lots 50-79) containing approximately 1,080 square feet each, for the use of exhibitors who desire to put up their own buildings. The carnival association will construct the facades without cost to exhibitors. These buildings must be completed on or before January 30, 1922.

The main exhibition building, a handsome structure designed by the carnival architect with special reference to light, air and convenience for exhibitors and visitors, provides for 104 exhibit booths (1-104) containing 100 square feet each, with wide aisle spaces and surrounding two open-air recreation courts and the sample fair theatre.

In the sample fair theatre, arrangements will be made for the exhibition of films supplied by exhibitors and for lectures explaining the films. Arrangements are being made for a merchants' convention during the fair and for a special merchants' day and merchants' ball as important features of the carnival program. Exhibitors occupying booths in the main exhibition building will be furnished janitor, watchman and usual lighting service free. Electric current for power purposes will be supplied at cost. Goods for exhibition in the commercial and industrial fair should be delivered on the carnival grounds on or before February 1st, 1922.

Applications for exhibit space in the commercial and industrial fair should be addressed to the secretary of the carnival association and should reach him on or before January 15th, 1922.

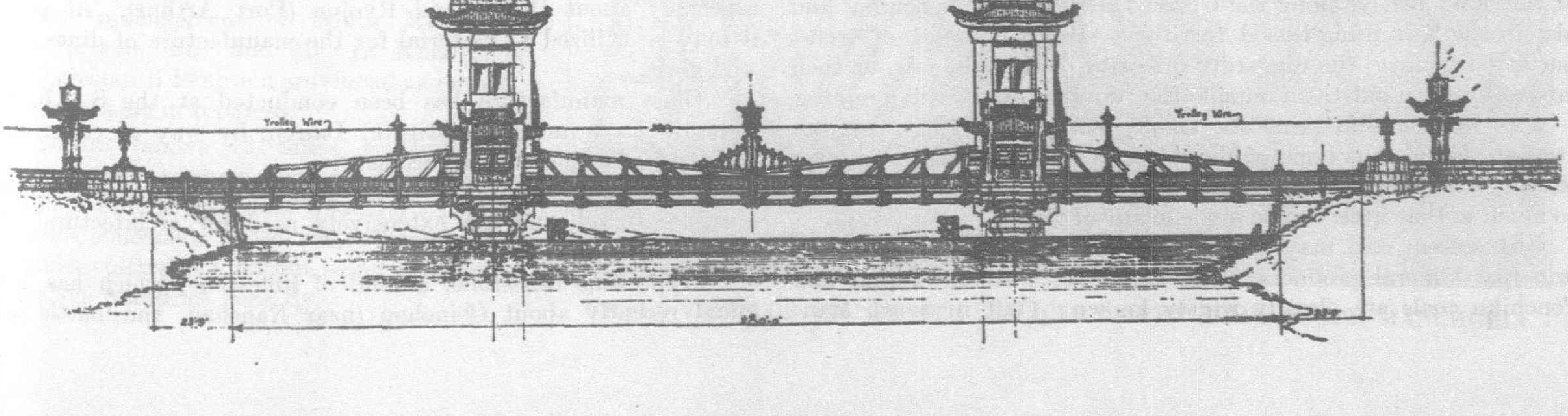
A uniform charge of $150.00 will be made for each booth in the main exhibition building and for each lot in the exhibition sites. A charge of $25.00 will be made for daily exhibition of films during the carnival. Remittance for the full amount should accompany the application and should be made payable to the secretary of the carnival association.

At the close of the commercial and industrial fair, all exhibits consigned to the secretary of the association will be stored at the expense of the exhibitor, pending his instructions.

A STRAUSS BASCULE BRIDGE FOR TIENTSIN

A BRIDGE having features of the latest Bascule type, but with pagoda-like towers and ornaments showing the traditional Chinese dragon, is being erected over the Pei Ho river at Tientsin. This bridge was designed by the Strauss Bascule Bridge Company of Chicago.

It will have a total length of 280 feet between abutments and consists of a Strauss vertical overhead counterweight double-leaf span, in the centre, 130 feet long between trunnions flanked on each side by fixed spans of 75 feet each. Designing this bridge was no easy task. The Chinese wanted the benefit of modern improvements, but everything with them had to harmonize with its surroundings. In a future issue, THE FAR EASTERN REVIEW will publish a more detailed description of this bridge.



Minerals in South Manchuria

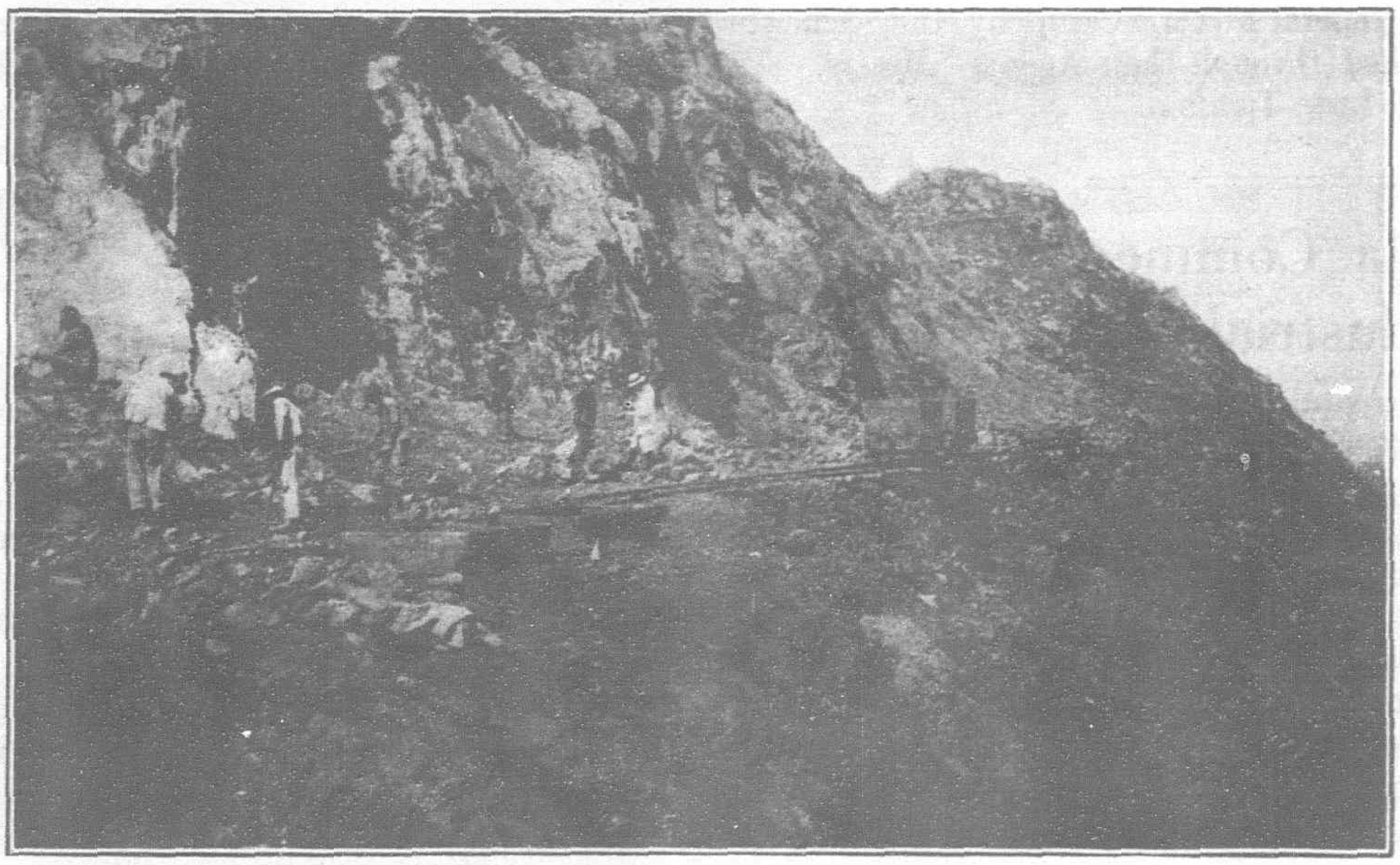
By Mr. B. TOHEIDA

THE principal mineral products of South Manchuria are gold, iron and coal. Of these that which has been worked most popularly was placer gold. But nowhere was it operated on a large scale, and there was little promise of great strikes. The best known places for these deposits are Chiapikou in the Sungari valley, belts in Tunghua and Huaijen in the valley of the Hun, a tributary of the Yalu River, Wufenglou and Wantientzu on the Upper Hun River running north of Fushun, belts in the Huifa River valley, and the valley of the Chai River flowing just north of Tiehling, in each of which places a good amount of placer gold has been gained in the past.

As gold veins, Chiapikou, Paomachuan (38 miles south of Tunghua), Hsiangluwantzu (about 12 miles southeast of North Shanchengtzu), etc., were operated vigorously at a time, but now all of them lie quite neglected.

At other places much prospecting and experimental working has been conducted, but nowhere for any length of time, and not a mine of any magnitude seems to have yet been struck.

As to iron mines, the belts about Anshan (the seat of the Anzan Iron & Steel Works of the South Manchuria Railway Company) and Kungchangling Pass, about midway between Liaoyang on the main line and Penchihu on the Mukden-Antung Line, are the principal ones. The iron ore bearing rocks of the Anshan district are wholly included in the hematite-quartz-schist, which is pre-Cambrian. The iron percentage is not high, but they are found in immense quantities. Moreover, rich ore zones giving more than 60 per cent. of iron occur here and there. At present the Anshan ores are being mined as material for the Anzan Iron & Steel Works. Next, as to Kungchangling mine, it is being prospected by the Kungchangling Iron Mining Co. organized under Sino-Japanese joint auspices. The ore for the Penchihu Colliery & Mining Co. is obtained mainly from Miaoerhkou at 25 miles southeast of Penchihu.



View of the West Anshan Iron Mine, Anshan, South Manchuria

Besides, iron mines are scattered over the northeastern part of the Yalu valley, along the Upper Taitzu east of Penchihu, and also in the Kwantung leased territory. However, want of transportation facility, the niggardly quantity of the minerals, or their inferior quality put them outside the province of extensive mining.

As for metallic minerals, silver, lead, copper, iron pyrites, etc., are found, but none of the deposits can be mined on a large scale. Their veins or seams run in irregularly varying dimensions, so much so that little can be made of any of them.

At present coal may well take the first place on the list of the principal mineral products. The names of Fushun, Yentai and Penchihu coals are already widely known. Coal in South Manchuria may be classified, according to the periods of its formation, into what belongs to the permo-carboniferous period, the jurassic period and the tertiary period. What belongs to the permo-carboniferous period is chiefly found in Liaotung Peninsula south of Fengtien (Mukden) in separate basins of small extent. The output is mostly anthracite or semi-anthracite. In many cases, a dozen or more coal seams lie overlapped one over another and are worth exploiting.

Especially, Penchihu coal has a high calorific power and is suited to the manufacture of cokes of splendid grade.

The common defect of the coals belonging to this period is that they contain sulphur and is brittle (although there are some exceptions). Then, they occur in varying thickness, which circumstance causes no small inconvenience to operation.

Next, what belongs to the jurassic period lies, in the main, in the north of South Manchuria. Takata colliery in Hsian prefecture in what is known as the Tungshan (Eastern Hill) district, to the east of Kaiyuan, may be held as representative of this class. The coal of this class contains most moisture and is the nearest approach to lignite, with a comparatively low calorific power.

That which belongs to the tertiary period occurs in the Hun valley only. Its chief exponent is the Fushun coalfield, and the others are good enough only for primitive mining by the natives.

The Fushun coal seam has an unparallelled thickness, and the coal is bituminous and rich in volatile matter. It is adapted to the production of gas and is also rich in nitrogen. Among its other characteristics, the rather high percentage of moisture and insufficient cohesion may be counted as its only shortcomings.

In regard to such minerals, as magnesite, barytes, asbestos, talc, fluor spar, fireclay, kaolin, felspar, etc. Magnesite and fire-clay are of high importance.

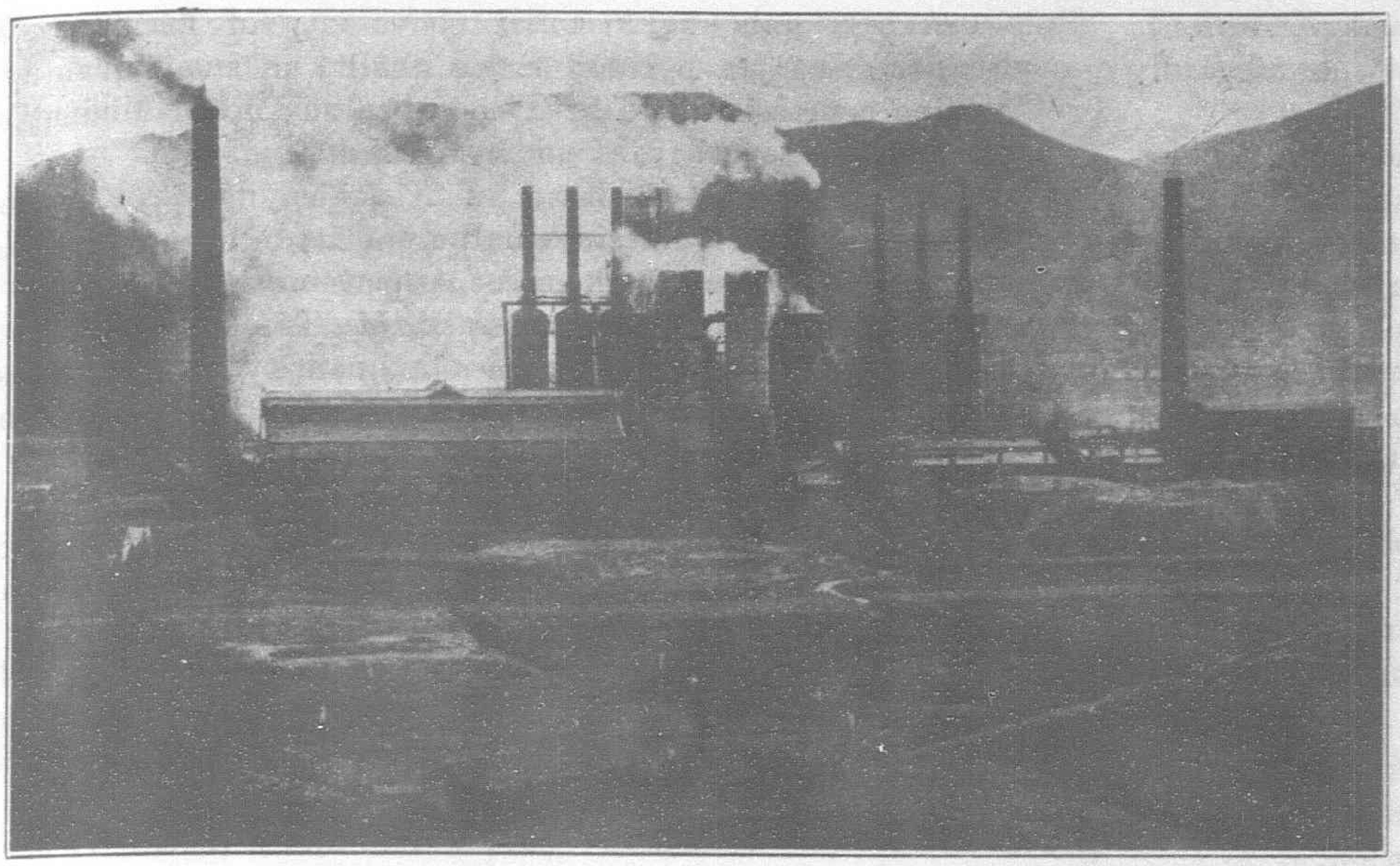
Limestone is seen at every turn almost and is used for making lime and cement.

Quartzite is distributed everywhere in Liaotung Peninsula, especially about Dairen and Ryojun (Port Arthur). At places, it may be utilized as material for the manufacture of dinas brick and glass.

Glass manufacture has been conducted at the S.M.R. Co. Ceramic Experimental Institute, Dairen, by way of experiment and with a fair measure of success.

In the line of building stone, granite, gneiss, and limestone, etc., are found, and are extensively used for architectural and earthwork purposes.

Cryptozone limestone, a kind of limestone, which has been found recently about Chinchou (near Nanshan, the battle field



at an hour's train journey from Dairen) is being used popularly for ornamental purposes.

Here follows a list where the various minerals of South Manchuria are deposited.

A. METALLIC MINERALS

(1) Iron

LOCATIONS :

YUHSIKOU (about 3 miles southwest of Tungyuanpu on the Mukden-Antung Line) : magnetite of passable quality found only in a meagre quantity; mining concession held by Penchihu Colliery & Mining Co.; operation commenced in 1919, but suspended at present.

MIAOERHKOU (5 miles east of Nanfen on Mukden-Antung Line): magnetite and hematite of passable quality found in a fair quantity; mining concession held by Penchihu Colliery & Mining Co.; now under operation, daily output being about 200 tons of rich ore.

ANSHAN (about $\frac{5}{7}$ mile south of Anshan station on S. M. R. main line) : magnetite and hematite of passable quality found in a considerable quantity; mining concession held by Anshan Iron Mine Chenhsing Co. under Sino-Japanese joint management, now under operation, output being supplied to Anshan Iron & Steel Works.

KUNGCHANGLING (about midway between Liaoyang on main line and Penchihu (on Mukden-Antung Line): magnetite and hematite of passable quality found in a considerable quantity; mining concession held by Kungchangling Iron Mine Co. under joint management of South Manchuria Enterprise Co. and Mr. Li Kuan-yung (chairman of Fengtien provincial assembly); prospecting in progress.

TALITZUKOU (about 13 miles southwest of Maotzushan): hematite of fine quality found but in niggardly quantity; no one holds concession to work it, it being in land under cultivation, output being supplied to native foundries near by.

CHITAOKOU (about 7 miles southeast-east of Tunghua): hematite of passable quality found in only niggardly quantity; no one holds concession to work it, it being in land under cultivation, output being supplied to native foundries near by.

KUANGTUNGTZU (15 miles north of Panshih): magnetite of passable quality found only in small quantity; mining concession held by the Hsinga foundry (a Chinese company); was mined about 1915 and output was made into iron, but venture proved failure, and work under suspension.

(2) Gold

LOCATIONS :

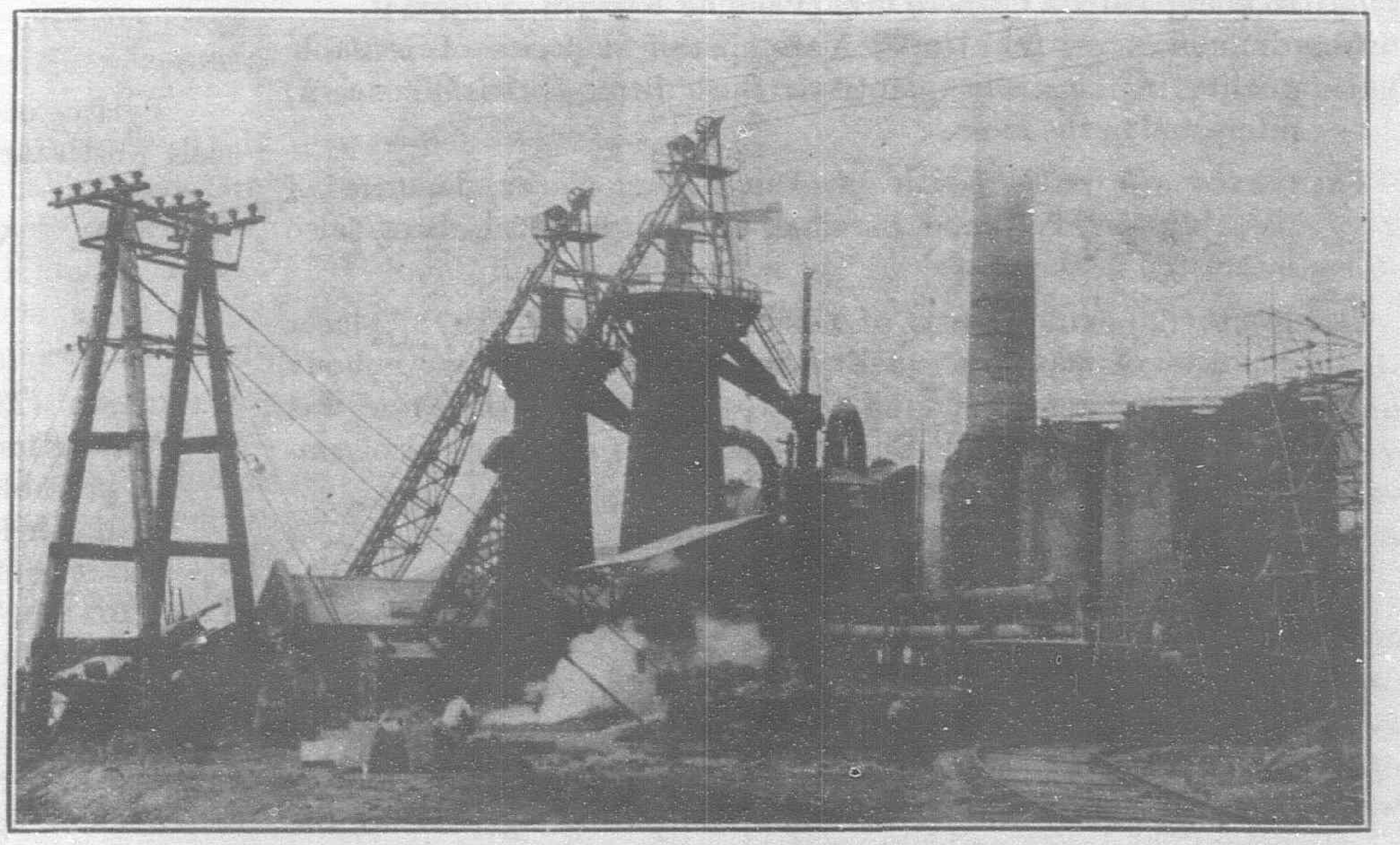
TUCHIATUN (about 18 miles southwest of Pitsuwo in northeastern corner of Kwantung leased territory): gold of indifferent quality found in small quantity; mining concession held by a Japanese of name of G. Inukai.

SUICHIATUN (between Tuchiatun and Yuanchiatun): gold of indifferent quality found in small quantity; mining concession held by the same Japanese as above mentioned.

LAOTIEHSHAN (southern extremity of Kwantung leased territory and south of Ryojun (Port Arthur): gold and placer deposits of indifferent quality in small quantity; mining concession for gold held by Kwantung government and that for placer deposits by a Japanese named R. Horiuchi.

YUANCHIATUN (about 2½ miles northeast of Pulantien): gold of indifferent quality in small quantity; mining concession held by a Japanese named G. Inukai; work under suspension and mine held by a Japanese named K. Toda, who financed operation.

WUFENGLOU (about 30 miles northeast of Hsingking); gold and placer deposits of indifferent quality in meagre quantity; about 1917, a Chinese firm under style of Hsingli Kungsu worked it for a time.



THREE VIEWS OF THE BLAST FURNACES AT PENCHIHU, SOUTH MANCHURIA

Changkang (about midway between Antung and Kuantien): gold and placer deposits of indifferent quality in niggardly quantity.

Hsiangluwantzu (about 12 miles southeast of North Shanchengtzu in so-called Tungshan (Eastern Hill) district: gold and alluvial deposits of passable quality found in a fair quantity; mining concession held by a Chinese concern under style of Hsingkuo Kungsu; difficult of mining after reckless operation.

Paomachuan (about 38 miles south of Tunghua): gold and alluvial deposits of passable quality found in fair quantity; mining concession held by Huachang Kungsu, Chinese firm; difficult of mining after reckless operation.

Chiupikou (30 miles east of city of Kirin): gold and alluvial deposits of passable quality in fair quantity; land, in which mine is located, held by an influential Koran family whose head is named Kantohkyo; difficult of mining after reckless operation.

Meichiatun (1.2 miles southeast of Sanshihlipu in Kwantung leased territory): placer deposits of indifferent quality found in small quantity; none holding mining concession.

Chinchangtun (about 13 miles northeast of Pitsuwo): placer deposits of indifferent quality in small quantity; nobody holding mining concession.

Tienpaoshan Silver and Copper Mine, located in the Chientao district and operated by the South Manchuria Development Co.

Sampatan (about 7 miles east of North Shanchengtzu, above mentioned): placer deposits of passable quality found in niggardly quantity; nobody holding mining concession; up to about 1916, a Chinese firm (Paolung Kungsu) worked it.

Wangerhshan on the Upper Yalu, placer deposits of passable quality in niggardly quantity; Bush Bros. (British concern) interested in the mine.

Tamiaokou (5 miles south of Tunghua): placer deposits of passable quality found in small quantity; Bush Bros. also interested in the mine.

Chaihopu (20 miles east of Tiehling on main line): placer deposits of passable quality in meagre quantity; nobody holding mining concession; up to about 1914, the mine was vigorously worked by Chinese and some Japanese also concerned in working it.

(3) Copper

Locations:

Tungkuangling ($1\frac{2}{3}$ miles below Antung along the Yalu): copper pyrites of fine quality found in small quantity; concession held by a Japanese named Dr. C. Uchida; mostly left neglected; worked at times, output being sold to the refinery at Chinnampo, Chosen.

Pichoushaotzu (about 126 miles above city of Kirin on the Sungari): copper pyrites of fine quality in small quantity; mining concession held by Pichoushaotzu Copper Mining Co. (a Chinese concern); work under suspension.

Santaokou (27 miles northeast of Kuantien): copper pyrites of fine quality found in small quantity; nobody holding mining concession; work under suspension.

Panling (about 18 miles northeast of Tsaohokou): copper pyrites of passable quality in meagre quantity; mining concession applied for by Sino-Japanese Mining Co. under joint management.

Panshih (about 12 miles northeast of Mapanshan (a mountain): copper pyrites and malachite of fine quality found in meagre quantity; mining concession held by Panshih Copper Mining Co.; work under suspension.

Malukou (42 miles east of Penchihu): copper pyrites of passable quality found in small quantity; mining concession held by a Chinese named Pao-shen; Okura-gumi (Baron K. H. Okura, the head) holding contract of mining and selling outputs.

Sutzuhuoko (or Tachaitzu) (about 32 miles above Tiehling on the Chai River): copper pyrites of fine quality found in small quantity; mining concession held by Kaiyuan under Sino-Japanese joint management; about 1916, Mr. K. Matsuoka of Tiehling experimentally worked it.

Tienpaoshan (10 miles southwest of Laotoukou, Chientao): copper pyrites and argentine of passable quality found in a fair quantity; mining concession held by the South Manchuria Development (Tahsing) Co.; work in progress; equipped with a refinery of an extensive scope.

(4) Lead

Locations:

Hsiaotientzukou (about 8 miles north-northeast of Chungku on main line): lead of fine quality found in small quantity; mining concession held by a Chinese named Hsu Ko-fang; work under suspension.

Tiennankou (25 miles west of Tungyuanpu on Mukden-Antung Line): lead of fine quality found in small quantity; mining concession held by Sino-Japanese Mining Co.; work in progress.

Chingchengtzu (about 27 miles west of Tungyuanpu): galena and iron pyrites of fine quality found in small quantity; concession held by Sino-Japanese Mining Co.; prospecting work in progress.

Laojenkou (about 12 miles southeast): lead of fine quality found in small quantity; concession held by nobody.

Erhpengtientzu (about 12 miles southeast of Huaijen): lead of fine quality in small quantity; concession held by nobody.

(5) Iron Pyrites

Pyrites occur at several places, but nowhere it is found on a scale worth mentioning.

B. NON-METALLIFEROUS MINERALS

(1) Coal

Locations:

Wuhutsui (23 miles west of Pulantien on northern border of Kwangtung leased territory): semi-anthracite, non-caking, of passable quality found in meagre quantity; mining concession held by a Russian, from whom Tayih Kungsu has leased, and it is under exploitation.

Tungchiakou (15 miles northeast-east of Chinchou): semi-anthracite, non-caking, of indifferent quality found in meagre quantity; concession held by Mr. Kimizuka, a Japanese; work under suspension.

Tsotzuyao (2 miles east of Wafangtien station): bituminous coal, non-caking, of indifferent quality found in small quantity; concession held by South Manchuria Railway Company.

Fushun (end of Fushun branch line): bituminous coal, slightly caking, of fine quality found in inmense quantities; concession held by South Manchuria Railway Co.

Outside Fushun mining area, there are Talien colliery, concession for which is held by South Manchuria Development (Tahsing) Co., and operated Oriental Coal & Mining Co. which also acts as sales agent; Achinkou colliery (concession for which is held by Chouwenkuei, resident of Dairen); Piaoerhtun colliery (concession for which is held by Junhsing Kungsu and Nanchang Yoko,

Yentai (9 miles east of Yentai on main line): semi-anthracite coal non-caking, of passable quality found in fair quantity; concession held by South Manchuria Railway Co.; under operation.

Outside the company's mining area, there is Weimingshan colliery, concession for which is held by Tienli Kungsu, daily output being about 100 tons.

Penchihu (close to Penchihu station on Mukden-Antung Line): semi-anthracite coal, caking, of fine quality found in fair quantity; concession held by Penchihu Colliery & Mining Co.; under operation.

Niuhsintai (10 miles east of Penchihu): anthracite coal of passable quality found in fair quantity.

Concession for eastern district held by Tsaiho Kungsu, a Sino-Japanese company; western district, which is Chinese mining area, is worked by a Japanese concern; Yuhsin Kungsu, which also acts as sales agent for output.

Hsiaoshih (40 miles above Penchihu on the Taitzu River): semi-anthracite coal, non-caking, of passable quality found in fair quantity; nobody holds concession to work it.

Saimachi (53 miles southeast of Penchihu): semi-anthracite coal, caking, of passable quality found in meagre quantity; concession held by Shuanghoyu Colliery Co., which is under contract with Oriental Coal & Mining Co., the latter working it and selling output; worked in native fashsin.

Tienshihfukou (55 miles east Penchihu): anthracite and semi-anthracite, slightly caking, of fine quality found in fair quantity; concession held. by Fuhua Kungsu and three individuals, who have given contract to Penchihu Colliery & Mining Co. to work it and sell its outputs; operated on native method and output sold locally.

Tataishan ($1\frac{1}{3}$ miles northwest of Tiehling): lignite, non-caking, of passable quality found in small quantity; concession held by Huasheng Kungsu; work under suspension.

Ilu (nearly $2\frac{1}{2}$ miles east of Hsintaitzu station on main line): lignite, non-caking, of passable quality found in small quantity; nobody holds working concession. Formerly Aishang Kungsu (a Japanese concern) was interested in it.

Shahotzu (nearly 4 miles northeast of Changtzu): lignite, non-caking, of passable quality found in meagre quantity; concession held by Tunghsing Mining Co. (under Sino-Japanese management).

Takata ($1\frac{1}{3}$ miles north of Takata in Tungshan (Eastern Hill) district): lignite, slightly caking, of fine quality found in fair quantity; concessions held severally by Paohsing Kungsu, Fukuo Kungsu, Yuhsing Kungsu, Tacheng Kungsu, Yuhua Kungsu and Chuanyi Kungsu. Moreover three applications for mining is on file; total annual output placed at about 60,000 tons.

Taolu (several collieries located at about 8 to 15 miles north of town of Taolu): lignite, slightly caking, of fine quality found in fair quantity; that part called Yatzuchuan operated by Tiencheng Kungsu and Mingshengfeng, concessionaires. Tapingling worked by Futai Kungsu; and Hsiao Lishuhotzu operated by Fengpei and Fengtung Kungsu; under operation on native method; total annual output, about 10,000 tons.

Shansungkang (23 miles southeast of Chaoyangchen): semi-anthracite of passable quality found in meagre quantity; mining concession held by Tahsingyao and thirteen others; mining work under suspension.

Panchiehkou (30 miles north-northeast of Liuho); semi-anthracite of passable quality found in small quantity; nobody holds mining concession.

Hsienjenkou (13 miles south-southeast of Liuho): semi-anthracite, caking, of passable quality found in small quantity; no one holds mining concession.

Tienhotun (8 miles southwest of Kuantien): semi-anthracite, caking, of passable quality found in fair quantity; concession under application by R. Minehata (a Japanese) and Li Hsien-hsien (a Chinese).

Wulungtun (67 miles south-southeast of Kirin): lignite, non-caking, of fine quality found in fair quantity; mining concession held by a Chinese concern named Tehsing Kungsu; work under suspension.

Tiehchang (20 miles northeast-east of Tunghua): semi-anthracite, caking, of fine quality found in meagre quantity; concession held by Paotai Kangsu and others; worked in native style.

Kangyao (33 miles north-northeast of Kirin): lignite, non-caking, of indifferent quality found in fair quantity; under joint management of Liu-tungkang (a Chinese) and J. Uchigaki (a Japanese); worked in native style, the total annual output being only 200 tons.

Huashihling ($2\frac{2}{3}$ miles north of Yingchengtzu on Kirin-Changchun Railway): lignite, non-caking, of passable quality found in fair quantity; concession held by Paochi Mining Co. (a Chinese concern); daily output between 20 and 30 tons.

Kwanchengtzu: (1) Shihpeiling, about 9 miles east of Changchun; (2) Taochiatun, about 13 miles southeast of Changchun: lignite, partially caking, of passable quality found in fair quantity; concession held by South Manchuria Railway Company; Shihpeiling colliery under operation by South Manchuria Mining Co.

Shansungpei in Chientao (20 miles north of Kwainei, the terminus of the proposed Kirin-Kwainei Railway): lignite, partially bituminous, of inferior quality found in meagre quantity; concession held by Huasheng Kungsu (a Chinese firm); work under suspension.

Laotoukou in Chientao (about 15 miles west of Chutzukai): lignite, non-caking, of passable quality found in fair quantity; concession held by South Manchuria Development Co.; Yenchi Mining Co. (Chinese) and a few others worked it in native fashion.

Tayaokou (30 miles southwest of Chinchow this side Shanhaikwan, accessible by a light rail line laid by Tungyu Kungsu (a Chinese firm) from Nuerhho station on Peking-Mukden Line of Chinese government railways): bituminous coal, non-caking, of fine quality found in meagre quantity; concession held by Chinhsi Colliery Co. under Sino-Japanese joint management; under operation, daily output being about 80 tons.

Hunglohsien (15 miles southwest of Chinchow this side Shanhaikwan): semi-anthracite, non-caking, of passable quality found in meagre-quantity; concession held by Aishang Co. and a few others; worked in native fashion.

Nuangtitang (25 miles southwest of Chinchow this side Shanhaikwan, the major portion of the mine belonging to Chaoyang prefecture): semi-anthracite, non-caking, of passable quality found in meagre quantity; concession held by the Peking-Mukden Line of Chinese government railways; under operation by natives who have leased it.

Hsinchiu (46 miles northwest of Lichiawopeng on Peking-Mukden Line of Chinese Government Railways): lignite, non-caking, of fine quality found in fair quantity; concession held by Tahsin Kungsu, Tahsing Kungsu, etc.; modern mining equipments being planned to be installed; besides, there are a few pits worked in native fashion, yielding about 160 tons daily.

(2) Magnesite

Chuanshantzu (2 miles due north of Shakang on main line): of fine quality found in fair quantity; concession held by Anshan Chenhsing Co. (under Sino-Japanese management), South Manchuria Railway Company, too, being interested.

Paihushan (about 3 miles due south of Tashihchiao): of fine quality found in fair quantity; concession held by Chenhsing Co., S.M.R. Co., too, being interested.

Kuanmashan (3½ miles east of Tashihchiao): of fine quality found in large quantity; concession held by Ho Chang-ching; worked at times.

Near Taling (4⅔ miles northeast of Tashihchiao): of fine quality found in large quantity; concession held by Yu Chung-han (a Chinese), S.M.R. Co., too, being interested.

Near Huashihchin (about from 9 to 14 miles southwest of Haicheng on main line): of fine quality found in large quantity; concession held by Yu Chung-han, S.M.R. Co., too, being interested.

Chinmaku (from 12 to 14 miles south-southeast of Haicheng): of fine quality found in large quantity; concession held by Yu Chung-han, S.M.R Co., too, being interested.

(3) Dolomite; (4) Limestone; (5) Quartzite

The three kinds of rocks above mentioned being widely distributed in a large variety in South Manchuria, any of them may be obtainable without difficulty, if sought in the right quarter.

(6) Clay

Yentai (running parallel to Yentai coal seam): fire clay of fine quality found in fair quantity; concession held by South Manchuria Railway Company; under operation.

Wuhutsui (being located within Wuhutsui coal field, 30 miles southeast of Fuchou): refractory clay of fine quality found in fair quantity; concession held by Yiho Clay Co., Tatung China-clay Co., and Tungyi Pottery Co. (all Chinese), in all of which S.M.R. Co., too, is interested more or less; work under suspension.

Tumenling (⅔ mile north of Tumenling station on Kirin-Changchun Railway): porcelain clay of fine quality found in fair quantity; investigation in progress.

(7) Asbestos

Hoshangtun (about 5 miles east of Chinchou in Kwantung leased territory): of fine quality found in small quantity; concession held by Japan Asbestos Co.; work under suspension.

Tahuangkou (1 mile northwest of Tahuangkou in Kuantien prefecture): of fine quality found in meagre quantity.

(8) Fluorite

Luchiatun (5 miles south-southeast of Luchiatun in Kaiping prefecture): of fine quality found in meagre quantity; concession held by a Chinese; Shimakyu, Druggists, Dairen, acting as sales agent.

Tsuichiatun (3⅓ miles west of Luchiatun): of fine quality found in meagre quantity; concession held by a Chinese; Shimakyu, Dairen, acting as sales agent.

Laomukou (6⅔ miles south of Haicheng station on main line): of fine quality found in small quantity; concession held by Kungy Kungsu, Haicheng; work under suspension.

(9) Talc

Sungchiaputzu (10⅔ miles south of Haicheng on main line): of fine quality found in fair quantity; mining concession held by Yu Chung-han, S.M.R. Co., too, being interested; worked at times.

Chingtzuku (about 8 miles over the hills, and about 18 miles over the cart road, south of Haicheng): of passable quality found in fair quantity: mining concession held by Yu Chung-han, S.M.R. Co., too, interested.

Maku (14 miles south of Haicheng and situated opposite Huashihling); of fine quality found in fair quantity; concession held by Yu Chung-han, S.M.R. Co., too, being interested.

(10) Felspar

Lienchiakou (2⅓ miles east of Shihho in Kwantung leased territory): of fine quality found in meagre quantity; no no one holds mining concession.

Shihtashan (6⅔ miles south southeast of Haicheng): of passable quality found in fair quantity; concession held by Chenhsing Kungsu; output under experimental use at Ceramic Experimental Institute of S.M.R. Co.

(11) Soda

Near Tsitsihar (in the Nen valley east of Tsitsihar): of fair quality; no reliable estimate obtainable as to its quantity; nobody holds concession.

Palishan (in Wentu principality and belongs to Chengchiatun in Liaoyuan prefecture): of passable quality; no reliable estimate obtainable as to its quantity; concession held by no one.

Tapusu (in South Kuoerhlossu, about 53 miles and southeast of Taonan): of passable quality; no reliable estimate obtainable as to its quantity; concession held by no one.

National Development Commission, Philippines

THE creation of a "National Development Committee," composed of the director of public works, director of agriculture, director of lands, director of forestry, and director of science, for the purpose of making an extensive and detailed study of the natural resources of the Philippines and recommending from time to time steps for their development, is the aim of a bill introduced at a recent session of the Philippine senate.

The duties of the committee as set forth in the bill are as follow:

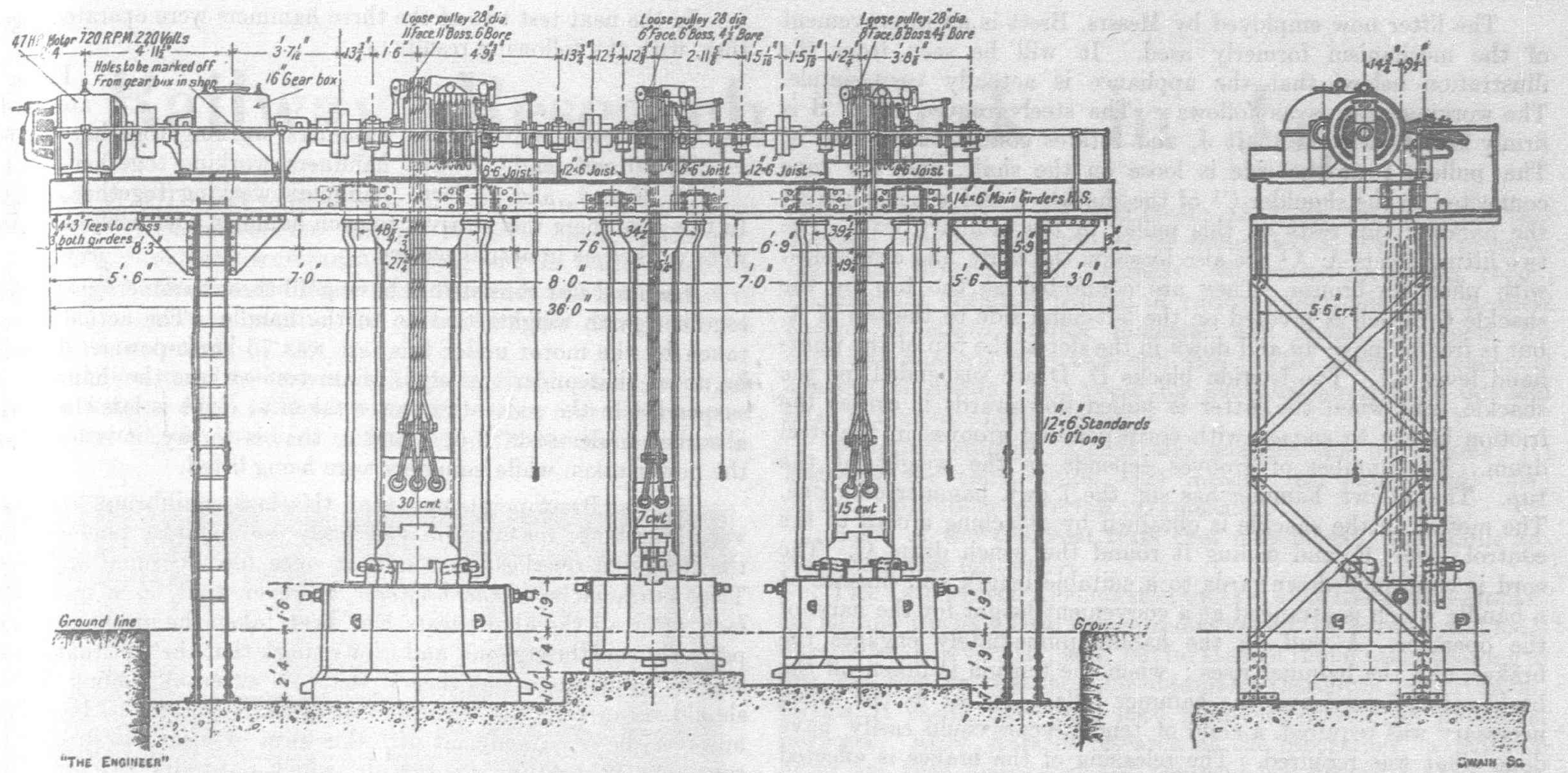
"*(a)* To explore, investigate, and make all necessary inquiries of the various natural resources of the islands so that the inversion of capital for the exploitation of these resources may be made advantageous.

"*(b)* To investigate, make an estimate of necessary expenditure, and make all necessary inquiries for the establishment of intercommunication between the various important points of Mindanao, especially the provinces of Agusan, Bukidnon, Cotabato, Davao and Lanao.

"*(c)* Explore, investigate and make all necessary inquiries in regard to the abundant mineral deposits in the islands.

"*(d)* Investigate and make a study of rivers and falls and cascades, determine their force, radius of action and the possibility of their being utilized as motive power for railroads, electric cars, electric plants and other industrial enterprises."

The committee is to be under the control of the department of agriculture and natural resources, and is to be presided over by the director of public works who is authorized to employ all technical personnel necessary fr the committee's work. The committee is to act for three years or until new ones or the same members are appointed. The sum of P40,000 is appropriated from the insular treasury for its expenses for 1922.

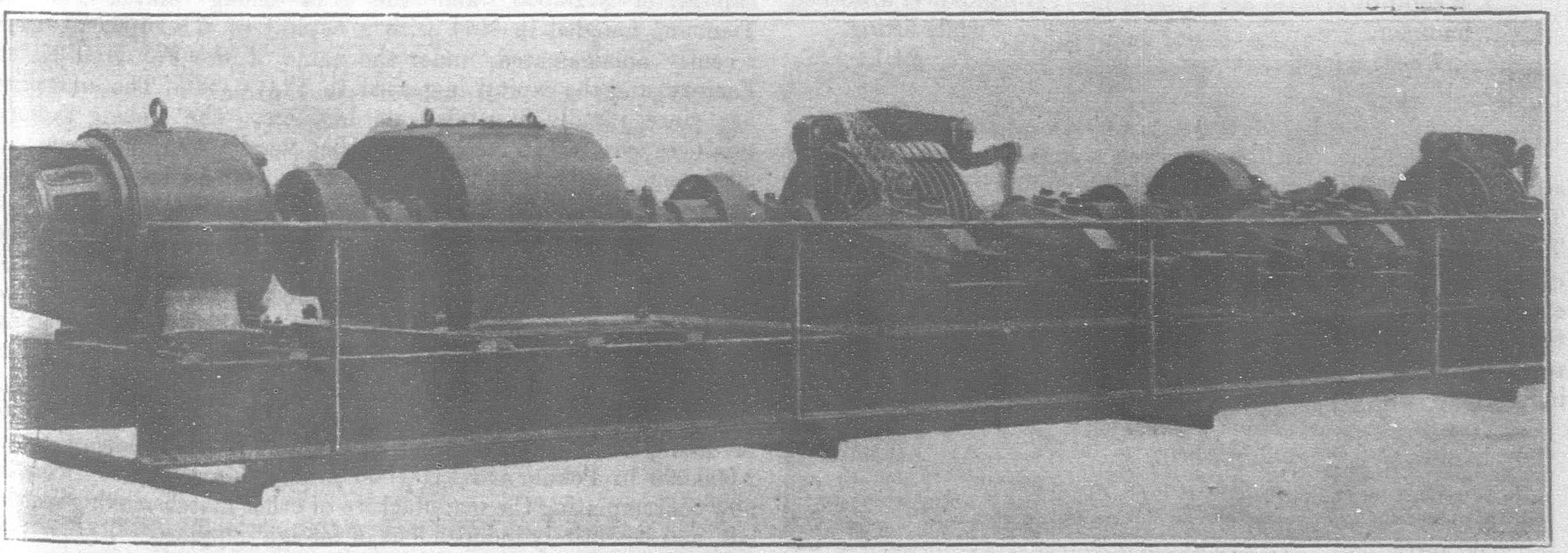

47 HP Motor 720 R.P.M. 220 Volts
Holes to be marked off From gear box in shop
16" Gear box
Loose pulley 28" dia. 11" Face. 11" Boss. 6" Bore
Loose pulley 28" dia 6" Face. 6" Boss, 4½" Bore
Loose pulley 28" dia. 8" Face. 8" Boss. 4½" Bore
8×6 Joist
12×6 Joist
14×6 Main Girders R.S.
4×3 Tees to cross both girders
36'·0"
5'·6"
7'·0"
8'·0"
3'·0"
5'·6" crs
12×6 Standards 16' 0" Long
30 cwt
7 cwt
15 cwt
Ground line
"THE ENGINEER"
SWAIN SC.

Electrically Operated Battery of Drop Hammers, manufactured by Brett's Patent Lifter Company, Ltd., of Coventry, England, supplied to the Tangshan Works of the Peking-Mukden Railway by Messrs. J. Whittall & Co., Ltd.

Drop-Hammer Battery for Tangshan Shops

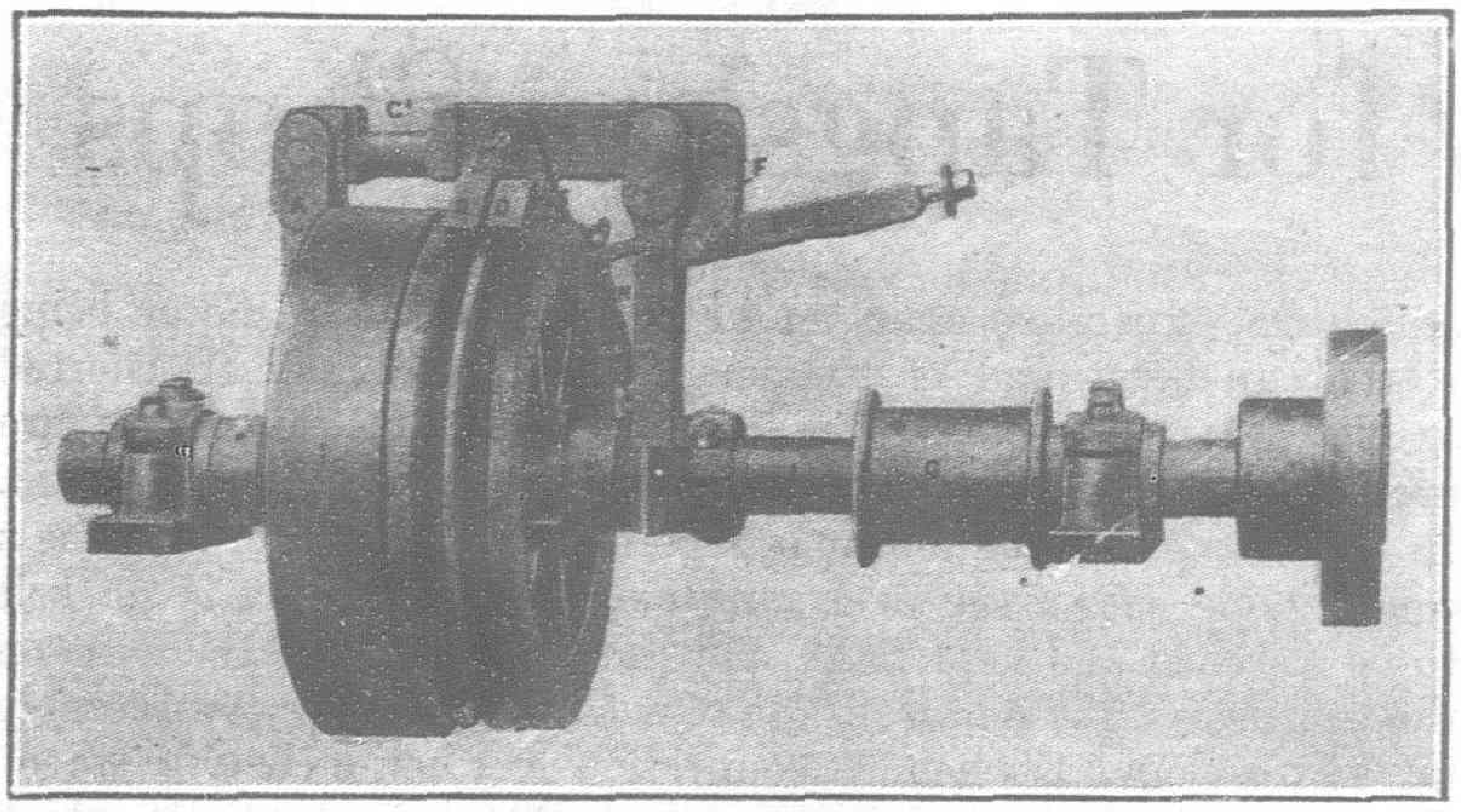
AN electrically-driven battery of three drop hammers has recently been completed to the order of J. Whittall & Co., Limited, by Brett's Patent Lifter Company, Limited, of Coventry. The battery, which is shown above, consists of a 30 cwt. and a 15 cwt. hammer for die work, with a 7 cwt. hammer, placed in between, fitted with roughing out or forming tools to act as a dummying hammer for the two larger sizes. It is intended for use in the engineering shops of the Peking-Mukden Railway.

As will be seen below, which shows the actuating mechanism of the hammers, the three lifters are mounted on a common shaft, which is built up in three sections with steel couplings, and is driven through double-reduction gearing, which is enclosed in an oil bath, an electric motor providing the motive power. The connection between the motor and gear-box takes the form of a centrifugal expanding coupling which permits of the motor being started up light, and of the power being gradually transferred as the speed increases. The makers point out that there are many advantages of such form of drive over the usual belt method. In the first place, the motor occupies no ground space, which is a considerable advantage in a stamp shop. Then there is no belt to be watched and kept tight, and, furthermore, that the wear on the bearings of the motor on the direct drive must be considerably more even than it is when the connection is by belt on to a fly-wheel. The gear wheels have machine-cut double helical wheels which run in an oil bath, and work with practically no noise when the plant is in operation. The enclosed gear-box has, of course, many advantages over open gears, especially when they have to work on a gantry which, under the load of the lifting hammers invariably springs, with the result that an even meshing effect is practically impossible.



Gantry and Hammer-Operating Mechanisms

The lifter now employed by Messrs. Brett is an improvement of the mechanism formerly used. It will be seen from the illustration below, that the appliance is actually very simple. The working of it is as follows: The steel grooved drum B is firmly keyed on to the shaft J, and rotates continuously with it. The pulley I at the side is loose on the shaft, and the rope connected to the shoulder C^1 of the shackle C and which supports the hammer tup rests on this pulley in the ordinary way. The two lifting levers A. A^1 are also loose on the shaft, and are bushed with phosphor-bronze. They are connected at the top by the shackle C, which is pivoted on the left-hand side to the top of A, but is free to move up and down in the slot at the top of the right-hand lever A^1. The friction blocks D, D are suspended for the shackle, and when the latter is pulled downwards it causes the friction blocks to engage with corresponding grooves in the steel drum. The number of grooves depends on the weight of the tup. The 30 cwt. hammer has six, the 7 cwt. hammer only one. The motion of the shackle is obtained by attaching a cord to the control lever E, and coiling it round the winch drum G. The cord is continued downwards to a suitable length and finishes at a handle which is arranged at a convenient height for the hand of the operator. A pull on the handle immediately engages the brakes, and the hammer rises; when the tension is taken off the brakes are released and the hammer falls. So far as the effort necessary was required, a child of tender years could easily have done what was required. The releasing of the brakes is effected by the action of the adjustable spring H. A practical feature of this lifter is that it gives an absolute control of the tup.



Latest Type of Brett Lifter Mechanism

The hammer can be lifted to any height and allowed to fall, or it can be suspended in the rods at any point and held perfectly stationary.

Following a test with recording ammeters, the three hammers were tested in rotation, and the following results were obtained:—

Weight of hammer.	Horse-power absorbed while lifting.
7 cwt.	24.1
15 cwt.	49.6
30 cwt.	83.14

In the third part of the test each hammer was, in turn, kept suspended, and the power to effect that condition was ascertained. This portion of the trial is, perhaps, the most interesting of the whole. There was no driver working the hammer, but to take the place of the pull of an operator a small weight was suspended from the end of the working cord, washers being added so as to give just the amount of weight required to cause the hammer to rise and remain in the rods. All the hammers were treated in this way individually, and the power absorbed was as follows:

Weight of hammer.	Horse-power absorbed.	Weight on handle.
7 cwt.	14.75	1-lb. 11 oz.
15 cwt.	26.82	2-lb. 8 oz.
30 cwt.	42.91	3-lb. 3 oz.

In the next test two of the three hammers were operated together, with the following results:—

	Power absorbed.
(*a*) 15 cwt. and 7 cwt. hammers working together	53.64
(*b*) 30 cwt. and 7 cwt. hammers working together	84.4
(c) 30 cwt. and 15 cwt. hammers working together	107.28

In this case there was a driver to each hammer, and both hammers were worked as in actual service.

The final test consisted in having all three hammers suspended together, with weights tied on to the handle. The actual power taken by the motor under this test was 75 horse-power. It is to be noted that under this equilibrium test—where the hammer is suspended in the rods—the power taken to drive is less than that absorbed under tests Nos. 2 and 4, that is to say, it is less than the power taken while hammers were being lifted.

Messrs. Brett point out that this last equilibrium test was very searching, for if there had been the slightest tendency for the lifters to overheat it would at once have become apparent. They assure us, says *The Engineer*, however, that, as a matter of fact, after all the above tests had been taken the mechanism was perfectly cool throughout, and they remark that the fact that it was so goes to disprove the theory that an external cooling device should be an essential feature of drop-hammer lifters. It should, however, be remarked that with this form of lifter the drums are continuously rotating in the air, which naturally has a cooling effect. We believe we are right in saying that no drop hammer had ever before been subjected to an equilibrium test of this character.

No particular comment is necessary on the general construction of the hammers, which conform to the general practice introduced by this firm many years ago. We may, however, remark that, whereas the brakes of Messrs. Brett's lifters used to be of phosphor-bronze, they are now made of a special material which has been invented by Mr. Herbert Froode, of Ferodo, Limited. The material is not, we understand, on the market in the ordinary way, but is made specially for Messrs. Brett, who state that it gives an excellent friction surface. The base blocks of the hammers are of cast iron, and they are of massive construction, being about fifteen times the weight of the tup. The overhead work is supported by strongly riveted steel girders, and the whole of the structure throughout is on ample and heavy lines. As is well known, there is no class of appliance which receives more severe punishment than a drop forging installation, and that fact is evidently kept well in view by Messrs. Brett.

Largest Match Factory in North China

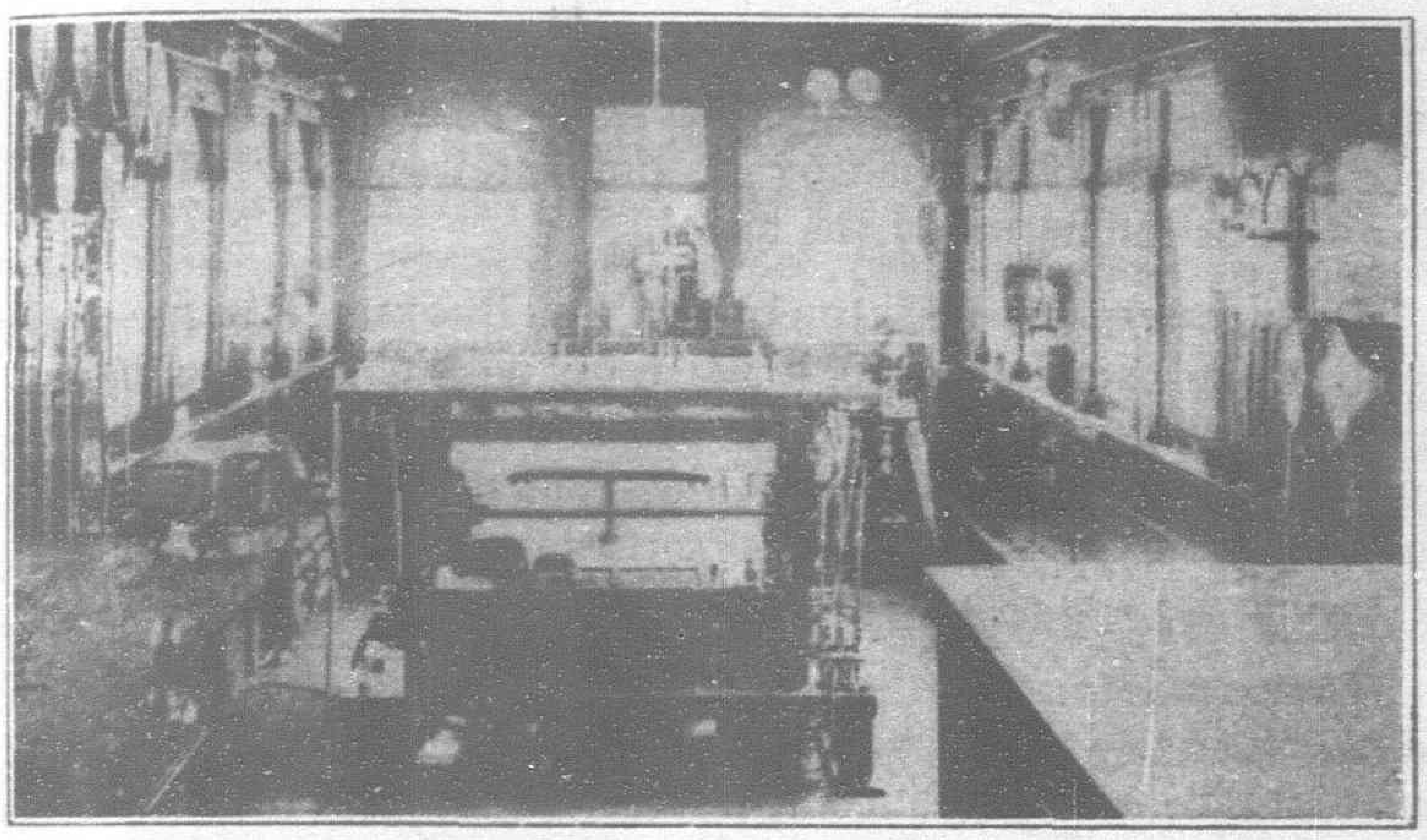
The Tai Feng Match Factory, Peking, founded in 1906 with a capital of $120,000, and the Hua Chong Match Factory, Tientsin, founded in 1911 with a capital of Tls. 100,000, were recently amalgamated, under the name of the Tai Hua Match Factory, and the capital increased to $2,000,000. The enterprise has since rapidly expanded its business. The Peking factory produces over 25,000 cases of matches yearly, with 300 men and 200 women workers, and the Tientsin factory about 16,000 cases yearly with 700 men and 60 women workers. The output is valued at $1,000,000. At the expiration of the patent right on 1919, the government granted a renewal for a further period of fifteen years, expiring in 1934. Soon after, branch factory devoted solely to the manufacture of match-sticks (which had been entirely supplied by foreign producers) was established at Antung where material is abundant.

The capacity of the factories is steadily increasing due to its favored position as the sole supplier for a population of about 2,000,000 in Peking and 1,500,000 in Tientsin. The company is now contemplating the manufacture of other match-making materials, and be entirely independent of foreign supplies.

Railway Research Work in Japan

TESTS and experiments on railway materials are in charge of the railway research office in the president's secretariat, Tokyo, and the office comprises the first and the second laboratory and the locomotive testing plant. The office also has charge of the district laboratories.

Technical tests and research work in the Japanese railways date back from April 1883 when simple testing was first carried out on cement purchased for railway use. On the nationalization of the private railways in 1907, a laboratory was established on the basis of the cement testing office in order to attend not only to the tests of strength and durability, but also to the chemical experiments on cement, volcanic ash, bricks and other kinds of materials. Both in 1910 and 1913 the scope of the work was enlarged and made to include fuels, paint, oils and all kinds of purchases for railway use, and further to cover the whole field of research on railway materials. At present the railway laboratory ranks, in point of equipment, scope of work, and efficiency, among the leading technical institutions in Japan.



Interior View of Dynamometer Car

The physical tests, chiefly on iron, steel and wood for rolling stock, that had been carried out prior to 1910 in the district workshops, were transferred first to the railway laboratory and subsequently to the charge of the railway research office, which had been improved in equipment and enlarged in scope.

The trial burning of coal is another important work undertaken by the office, a special plant for this purpose having been installed in 1913. The plant is of the same pattern as that sent by the Pennsylvania Railroad Company to the Louisiana Purchase Exhibition in 1910.

The work of finding possible substitutes for the Japanese chestnut timber, which forms the bulk of the railway sleepers used in our country, has been carried on since 1913 at the railway research office. In this laboratory creosoting and micrological testing rooms were newly equipped, so that, besides physical and chemical tests and experiments, micrological experiments were commenced not only on railway sleepers, but on timbers in general and, further, on some food stuffs that are apt to putrefy while in the train.

Lastly, it was decided in December 1916 to provide equipment for researches in electricity. The building has already been finished, and machines and other equipments are on the point of being installed.

Chemical Tests

Equipment.—The laboratory consists of twelve rooms as enumerated: (1) Cement strength testing room; (2) room for chemical analysis of iron and steel; (3) room for chemical and vacuum tests on the strength of rubber-wares; (4) gas generating room; (5) room for balances; (6) cement analyzing room; (7) room for chemical testing of rubber; (8) room for chemical testing of elastic rubber material and cloth; (9) room for chemical analysis of water and fuel; (10) room for chemical analysis of paints; (11) room for chemical analysis of oils and fats; (12) metal analysis room.

Materials subject to tests and analysis are as follows: (1) Materials for construction; (2) metals; (3) paints; (4) oils; (5) fuel; (6) rubber materials; (7) cloth.

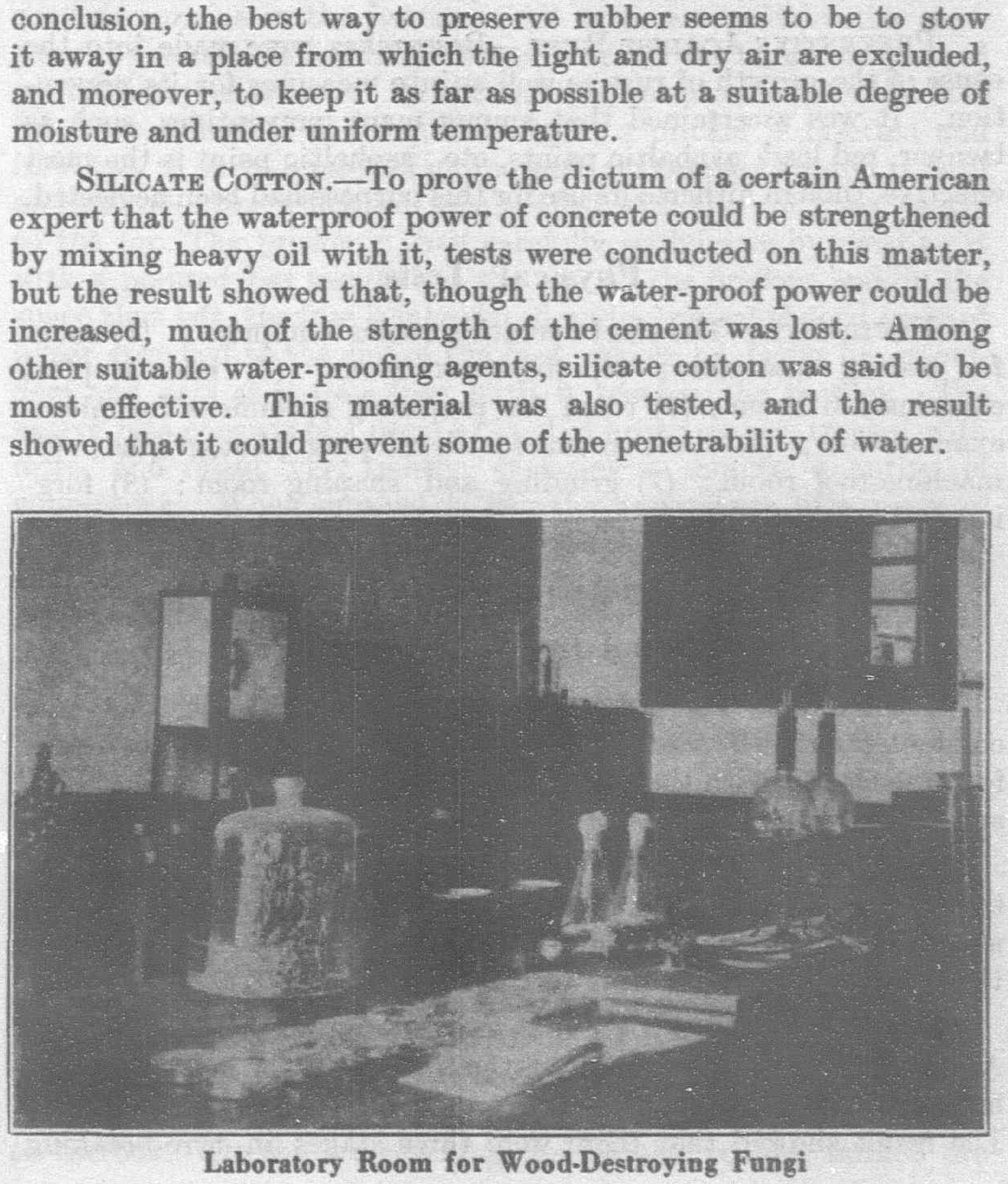
Some of the chemical tests that may interest the public are summarized as follows :—

The Industrial Application of Japanese Lacquer.—Japanese lacquer has long been recognized as one of the hardest and most durable kinds of varnish, and, but for the fact that it takes too long to dry, and, further, that the color obtainable thereby is rather monotonous, it would have been used more extensively for industrial purposes. After years of research at the laboratory, a suitable dryer has been discovered and the way has opened for the wide industrial application of this material. At present oil paints are being gradually replaced by lacquer, which is far harder in texture. Lacquer has also been found good as a pigment, and the field of the economic use of this juice has been considerably enlarged.

Petroleum for Lighting Purposes.—As a result of comparative investigations it was found that the Japanese light oils, if special mouthpieces be fitted to signal lamps, can be used as substitutes for mineral or colza oil, the light lasting from 12 to 36 hours.

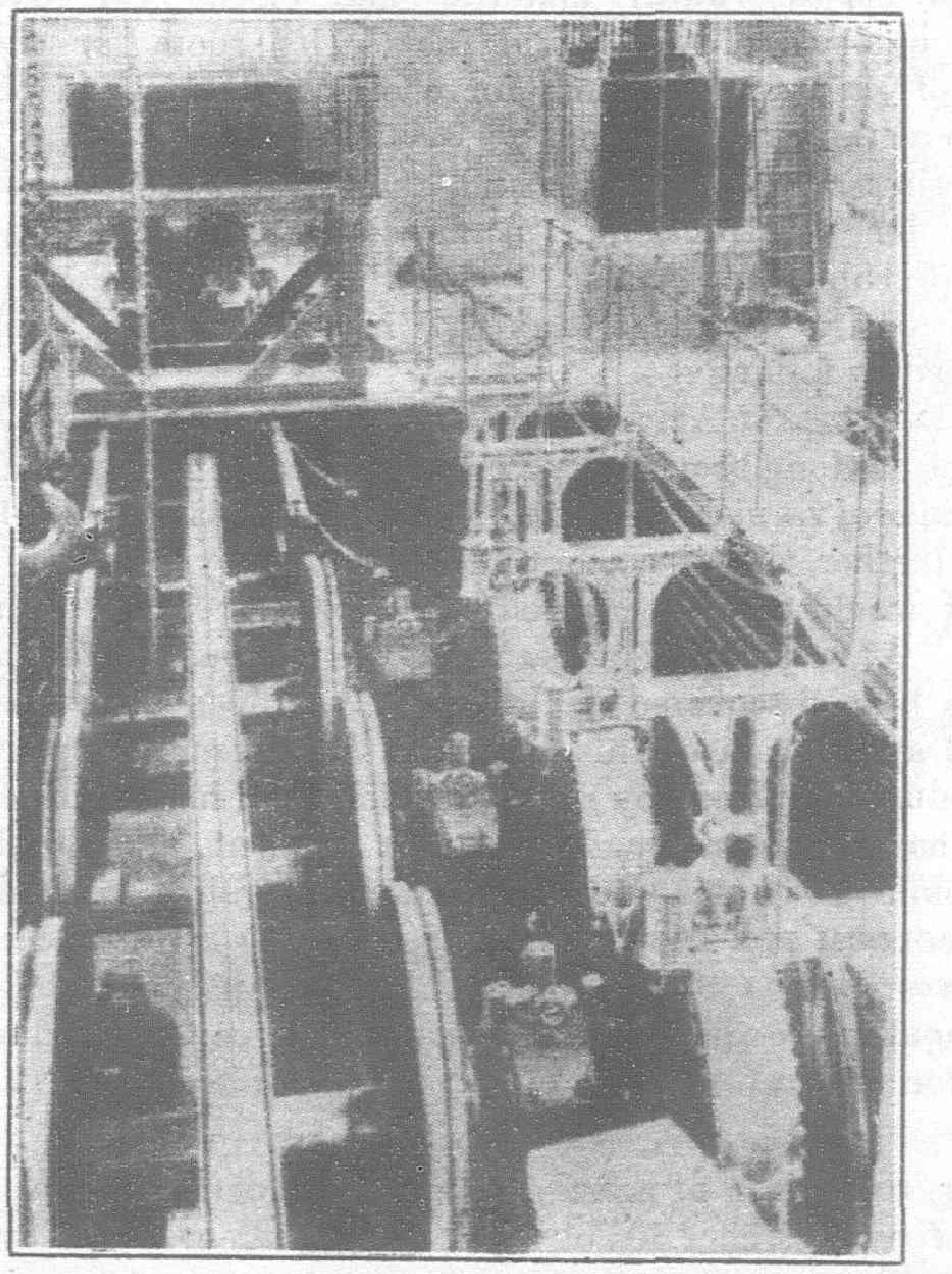
Test on India-rubber.—To prevent deterioration in the quality of india-rubber by oxydation or other causes, it was ascertained that oxysalt is the best mineral compound to mix with raw rubber. Though it is not yet possible to arrive at a final conclusion, the best way to preserve rubber seems to be to stow it away in a place from which the light and dry air are excluded, and moreover, to keep it as far as possible at a suitable degree of moisture and under uniform temperature.

Silicate Cotton.—To prove the dictum of a certain American expert that the waterproof power of concrete could be strengthened by mixing heavy oil with it, tests were conducted on this matter, but the result showed that, though the water-proof power could be increased, much of the strength of the cement was lost. Among other suitable water-proofing agents, silicate cotton was said to be most effective. This material was also tested, and the result showed that it could prevent some of the penetrability of water.



Laboratory Room for Wood-Destroying Fungi

Efflorescence of Bricks.—Investigations into the cause of the efflorescence much in evidence at cracks in brick structures, confirmed the assumption that the incrustation is largely responsible for the premature decay of the structures, the fact being revealed that the surface of bricks is spoiled by the action of the efflorescence which appears thereon, and which, in turn, tends to hasten the internal decay of the bricks. It was found that the best preventive of efflorescence was to minimize the amount of moisture absorbed in the substance of the bricks.



Locomotive Testing Plant

Preventive Against Rust.—Researches were made into the cause of the growth of rust as well as into measures for its prevention. It was ascertained that among many preventives, such as lacquer, red lead, asphaltic paints, etc., asphaltic paint is the most effective, though hitherto its use for this purpose had been neglected.

Physical Tests

Equipment.—The chief operating rooms comprise: (1) room for testing materials; (2) fire-work room; (3) microscopical examination room; (4) room for preparing specimens for micro-examination; (5) dark room for developing photographs; (6) machine-tool room; (7) grinding and shaping room; (8) forging and casting room.

Results of Some of the Principal Researches and Investigations

Researches on Train Lighting.—An investigation was conducted as to the merits of coal, gas and acetylene as substitutes for pintsch gas, with the result that pintsch gas was found a little superior to any other.

Comparative Testing of Rails.—As the result of thorough tests carried out on rails made by the government iron foundry and on those of the Carnegie Company, it was ascertained that the former were not inferior to the latter.

Signs of Breaking of Tyres and the Preventive Measures Adopted.—With a view to investigating means of preventing the breaking of tyres, technical trials were conducted on various tyres. The result showed that there were three stages in tyre-breaking and that, if proper measures were taken at the first stage or at the beginning of the second stage of breaking, the fracture could be prevented.

Investigation into the Explosion of an Engine.—With a view to tracing the cause of the engine explosion, which took place on the Echigo Railway Company's line, the boiler barrel plate of the exploded engine was examined, and it was ascertained that the disaster was due to flaws on the surface of the plate, for which the defective forms of the joints and the improper use of material were responsible.

Research on the Cracking of a Fire-box Tube Plate.—As a result of the research regarding the fire-box tube plate of No. 8855 locomotive, which plate was partly cracked, it was ascertained that the crack was traceable to the exhaustion of the plate caused by the difference of expansion on both sides of it.

Investigation as to the Effects on the Substance of the Remelting of Gun-metal.—As the result of investigation it was ascertained that the remelting of gun-metal scarcely affects the substance or the nature of the metal.

Researches on the Substance of Broken Rails.—As a result of the examination of three rails, which had been broken on the north-eastern line, it was discovered that the causal parts were all at the bottom, where thin scales and slag had formed when the rails were cast. The corrosion of the metal caused by its long use was also determined to be partly responsible.

Investigation into the Breaking of Springs.—As the springs used Sy No. A—21, 600-pattern goods wagons were frequently broken, some comparative tests were conducted on many broken springs. It was found that the slag which had become incorporated in the metal, and the insufficiency of tempering, as well as the weak points caused by the flaws produced in the substance during manufacture, had combined to bring about the defect.

Locomotive Testing Plant

The plant is in Oi-machi, in the suburbs of Tokyo, and is equipped with a locomotive testing room fitted with supporting wheels and axles, brake-gear, apparatus for measuring the tractive force of the locomotive, water supply and fuel supply; pump room and main tank; laboratory; and dynamometer car.

From the beginning of the work in 1913 to the year 1917, 69 cases of trial combustion of coal, 1,523 tests on the analysis of fuel, and 32 tests on locomotives were carried out.

Some of the results obtained are as follows:

In the comparative test for determining the relative merits of the 'one shovel' and 'bunking' systems in regard to coal combustion, it was proved that the former system was superior to the latter.

Burning Test on the Efficiency of the Boiler According to the Water Level.—Experiments made to determine the most advantageous height of the water in the boiler showed, as carried out on the relative efficiency of different levels—high, middle and low, that the higher level produced the better result in this country.

Blast Nozzle and Indicator.—The experiment proved that sizes between 4¼ and 4⅜ inches, with the tip of the nozzle located near the boiler centre, would give the best result at a speed of 15 miles and with the work of about 400 h.p., and the form of the nozzle would make no material difference, provided the dimensions were unaltered.

Supply of Air through the Fire-door.—The test made on the combustion of coal with the fire-door open revealed the fact that the supply of air from the open door may be productive of better results by about 10 per cent.

Baffle-plates.—Doubts as to the relative advantage of the use of short baffle-plates led to tests on baffle-plates of various lengths—9-in., 18-in., 24-in., and 36-in.—and the 24-in. plates were found to do the best work.

Tests on the Efficiency of Locomotives (2,500).—As the efficiency of locomotives at various speeds and cut-offs, tests showed that in hauling the common weight the most economical speed was 12½ miles per hour.

Tests on Timbers

The timber laboratory forms a section of the chemical laboratory and consists of three main rooms, viz.: (1) room for impregnation of wood preservatives, (2) chemical analysis room, and (3) room for the pure culture of micro-organisms. Results of chief investigations are mentioned below:

Creosoting of Sleepers.—Obtuse ground cypress formed the material of the bulk of the sleepers subjected to the test, and it was ascertained that the quantity of creosote required for treatment is 4.5 *sho* (1.8 gallons) per sleeper. It was also proved by subsequent experiments that creosote oil is the best and most economical preservative.

Blighted Arbor Vitae.—In compliance with the request of the forestry bureau, tests were made upon the strength and durability of the arbor vitae procured in Aomori prefecture. These trees had been blighted in large numbers by smoke, and it was ascertained that the blighted timber was equally serviceable as material for car-building and for long sleepers.

Ceratostomella Pilifera (Fr.) Wint.—As regards the blue stains which often appear on the wood while undergoing desiccation, thereby damaging its quality, it was found on investigation that the damage was due to the noxious bacteria known as "*ceratostomella pilifera (Fr.) Wint.*" Artificial culture showed that the bacteria is very rapid in growth, and that a solution of corrosive sublimate or fluid of soda is the most effective preventive for it.

District Laboratories

There are three district laboratories, at Kobe, Moji and Sapporo, which, under control of the central laboratory, attend to the testing of railway stores of local importance.

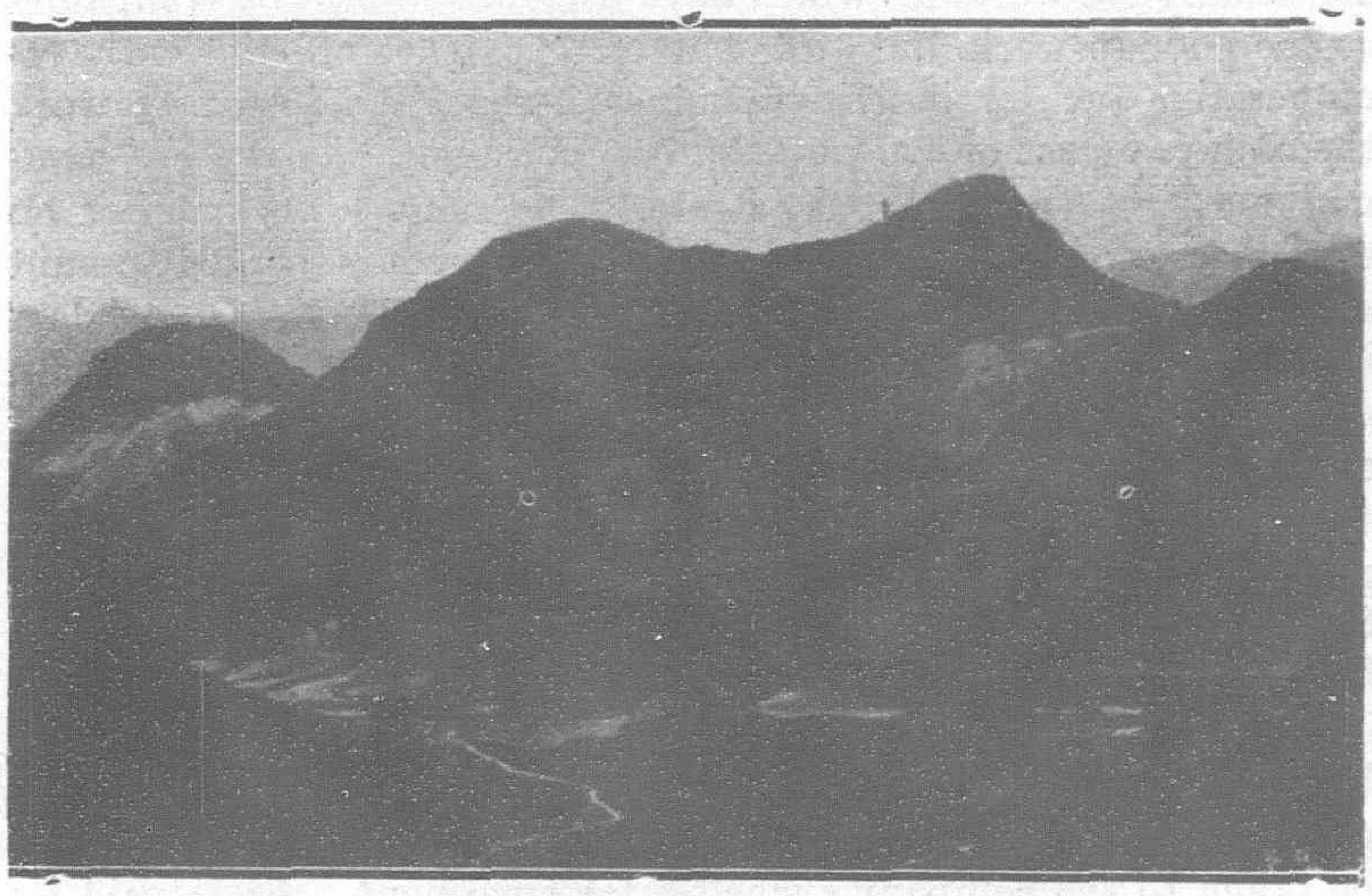
Quicksilver Mining in China

AT a meeting of the Cornish Institute of Engineers, Frank Trythall read a paper describing the mining of quicksilver in the Toonyen prefecture, Kweichow province, South China. Quicksilver has been extensively mined in Kweichow, for how long no information can be obtained beyond the assertions of the landowners, who claim that their ancestors were mining for quicksilver during the Ming Dynasty (1368-1644). Gunpowder was introduced for the first time as an explosive about the year 1870 by miners from Szechuan. Previously fire-setting and the hammer and gad were the only means of mining. The geological formation of the region is magnesian limestone, in horizontally stratified beds of several hundred feet in thickness. The mineralized zone is roughly three miles square. The quicksilver deposits are not continuous, and they are irregular in shape. The country is cut by canyons running in various directions, and it is noticeable that those deposits which are near the rim of the canyons are richer and more extensively worked than those occurring farther afield. The ore occurs: (1) As impregnation of well-defined beds of limestone; (2) along the joints, cracks and planes of stratification; (3) in isolated bunches, nests or pockets, and in vughs or cavities which contain crystalline aggregates or well developed crystals of cinnabar in the form of penetration twins of two rhombohedra, associated with quartz and calcite; (4) irregularly disseminated through a number of beds which have, in most cases, undergone considerable local disturbances. There are two varieties of cinnabar. One is a bright, transparent red, the other a dark, opaque red with which antimony is almost invariably associated in small quantities. The former is known as the "red," and the latter as "black" cinnabar. Pyrites is entirely absent. Native mercury is occasionally met with, associated with the antimonial ores. These deposits are similar to, and characteristic of, others in the districts of Beh-mah-tung, Wuchuan and Pachai.

The methods employed in mining and smelting are distinctly crude, and conform to no laws or regulations. About the time of the writer's visit, mining regulations were issued by the imperial government, but were never enforced, nor was the slightest notice taken of them. In the mines known as "private" mines, which have been acquired by a company, the miners are required to sharpen their own drills before entering the mine, and drill and fire two 15-in. holes. They drill single-handed with 7-lb. hammers, a back hole counting double. The drills, ¾-in. diameter, are of iron, pointed with steel at both ends. Other mines, described as "public," are usually old workings which have been abandoned by companies as too poor to work, but still containing patches of sufficiently remunerative ore for individual miners, who are allowed to work them on payment of 600 case (1s. 7d.) per month, known as "hammer tax," to the local magistrate. The miners work either on day's pay or on tribute. In the first case the hours worked amount at most to six; but every fifth day, being market and pay day, is regarded as a holiday, when they receive 400 cash (about 1s.). In addition to the wages they are supplied daily with two meals, consisting of boiled rice and vegetables, and on market days a small portion of pork. The meals cost roughly 50 cash or 1.6 pence each. Thus a miner on day's pay earns, inclusive of his food, 130 cash (4.2 pence) per day, and works at the outside 24 hours in five days. Overtime is paid on all holes drilled above two in a shift at the rate of 1.2 pence per hole. The tributer supplies his own tools, explosives, etc., and works without restriction on a piece of ground allotted to him by a company, and his ore has to be taken to the company's smelter for treatment. He is paid for the quicksilver so produced at a rather lower rate than the prevailing market price, and, in addition, the buyer retains such mercury as remains in the furnace. All taxes are paid by the company to the officials and land-owners, whether the mines are worked on day's pay or tribute. In the blasting operations, after the hole has been drilled to the required depth, a pricker is inserted and from two to three ounces of gunpowder are tamped around it with an iron rod, after which the hole is filled with clay, or fines, nearly to the top. The pricker is then carefully withdrawn by twisting it with a pointed bar inserted in the eye of the pricker, and, in the space thus left, the fuse is introduced and a conical-shaped piece of paper attached to the end of the fuse, which, on being lit, smoulders and acts as a time fuse until it reaches the powder. The native fuse consists of a peculiar kind of brown paper, treated with nitre, and rolled very tightly, enclosing a minute quantity of gunpowder. When finished it has the appearance of a piece of whip cord. The timing is very unreliable. Owing to the inferior quality of the gun-powder (which is made on the mines from ingredients obtained locally), the explosive force is small, only from 200 to 300-lb. of rock being dislodged per hole drilled.

No system of driving, sinking, or stopping is observed in the winning of the ore, the miner simply following a stringer on a mineralized band of ore, enlarging or reducing his working face as the mineral widens or pinches, resulting in a series of intricate workings. Timbering is unnecessary, as the ground is compact and holds well, even in the largest workings. The ore is transported from the working face to the surface by means of baskets carrying 30 to 40-lb., fastened to the coolie's back by ropes which pass under the arms. In the very low and narrow workings where it is impossible to stand upright, wooden boxes containing the ore are drawn along the floor by small boys, crawling, with a rope passing around the neck, down the stomach, between the legs and attached to the box. On the ore reaching the surface, coolies, termed ore pickers, cob and pick it, as much as possible of the barren rock being discarded. The large crystals of cinnabar are detached by means of a stout pointed wire. The ore is crushed on a large flat stone with hammers, to pass a ⅛-in. bamboo sieve, and if the cinnabar is of the red variety, it is panned, the concentrates removed, and the tailings treated for quicksilver in the furnace retort. If the cinnabar is black, the panning is dispensed with, and the whole put direct into the furnace.

During the winter months, when agricultural labor is more or less at a standstill, a large percentage of the population turn their attention to the working over of the old dumps, and may be seen wending their way to the dumps at all hours of the morning, armed with a basket, hammer and rake, and sometimes a lamp to enter the abandoned mines, returning in the evening with perhaps 10 to 15-lb. of picked ore containing 1 per cent. to 2 per cent. quicksilver. This ore is disposed of to the owners of private furnaces, of which there are a number scattered about the district. Pumping is a minor item, from the fact that the deposits are not deep-seated, and the deeply carved and fissured country does not permit of the accumulation of large quantities of water, which would prevent the natives from carrying out their primitive modes of mining. Where water accumulates in sufficient quantities to check operations, a bamboo or wooden chain-pump is installed, similar to those used for irrigation purposes, but if they prove inadequate, the workings affected are abandoned until the water recedes. Ventilation is also a question which does not worry the Chinese miner. The imperfect combustion of the explosive, the smoke arising from the oil lamps, the filthy habits of the miners themselves, and the fact that many absolutely live in the mine for fear of having their rich ore stolen, tend to make the air as foul as it is possible to conceive, and often, on entering a working, it is almost impossible to see how many are at work or what is being done. The miners will submit to all these discomforts and dangers to health rather than do any work which would cause expenditure without direct remuneration.


Patungla Quicksilver Mines, Kweichow

The furnaces, built in pairs, are 2-ft. 6-in. in diameter and 1-ft. 6-in. in height. Each consists of a cooking pan, which serves as a receptable for the ore, resting on a round fire-place made of unburnt bricks, on which is placed a similar pan inverted, with a 12-in. hole in its centre. On this is built a collar of clay, 12-in. high, strengthened by a plaited bamboo network, extending a few inches above the clay collar, serving as a support to the upper pan. The top of the clay collar is grooved in the centre, and a third pan, with a 12-in. diameter hole, rests on its inner rim, and this, being covered by an earthenware pot which acts as a condenser, an annular space is formed between the groove, the lower part of the top pan, and the inner side of the bamboo network. Three holes ¾-in. diameter are pierced through the rim of clay on which the topmost pan rests, and are known as "percentage holes," inclining towards the centre of the furnace. The amount of quicksilver collected in this annular space depends on the inclination of the percentage holes, increasing in quantity as the angle of inclination increases. The earthenware pot or condenser is luted with fine residues and the bamboo network is lined with clay. Wood fuel is used for heating purposes. The usual charge for one furnace is 50-lb. of ore. The quicksilver vapours condense in the annular space and earthenware pot, which is changed at intervals until the ore is exhausted, when the residues are withdrawn by means of a shovel the blade of which is at right angles to its handle, and replaced by another charge. While the condenser is being changed, the ore in the pan is stirred with a wooden pole, the fumes escaping copiously during the operation. The condenser becomes coated with minute globules of quicksilver, which on removal are run together by rubbing the surface with a rag forming a pool at the bottom of the pot. The losses, as far as can be estimated, vary between 30 per cent. and 40 per cent. of the total quicksilver. The amount collected in the condenser naturally depends on the richness of the ore treated, and sometimes as much as a catty (1.3-lb.) is collected. The metal is poured into bamboo flasks and eventually transported to the river ports in pigs' bladders. The residues, especially in the case of rich ores, which still contain imperfectly burnt ore, are ground by hand, sluiced and the concentrates again retorted.

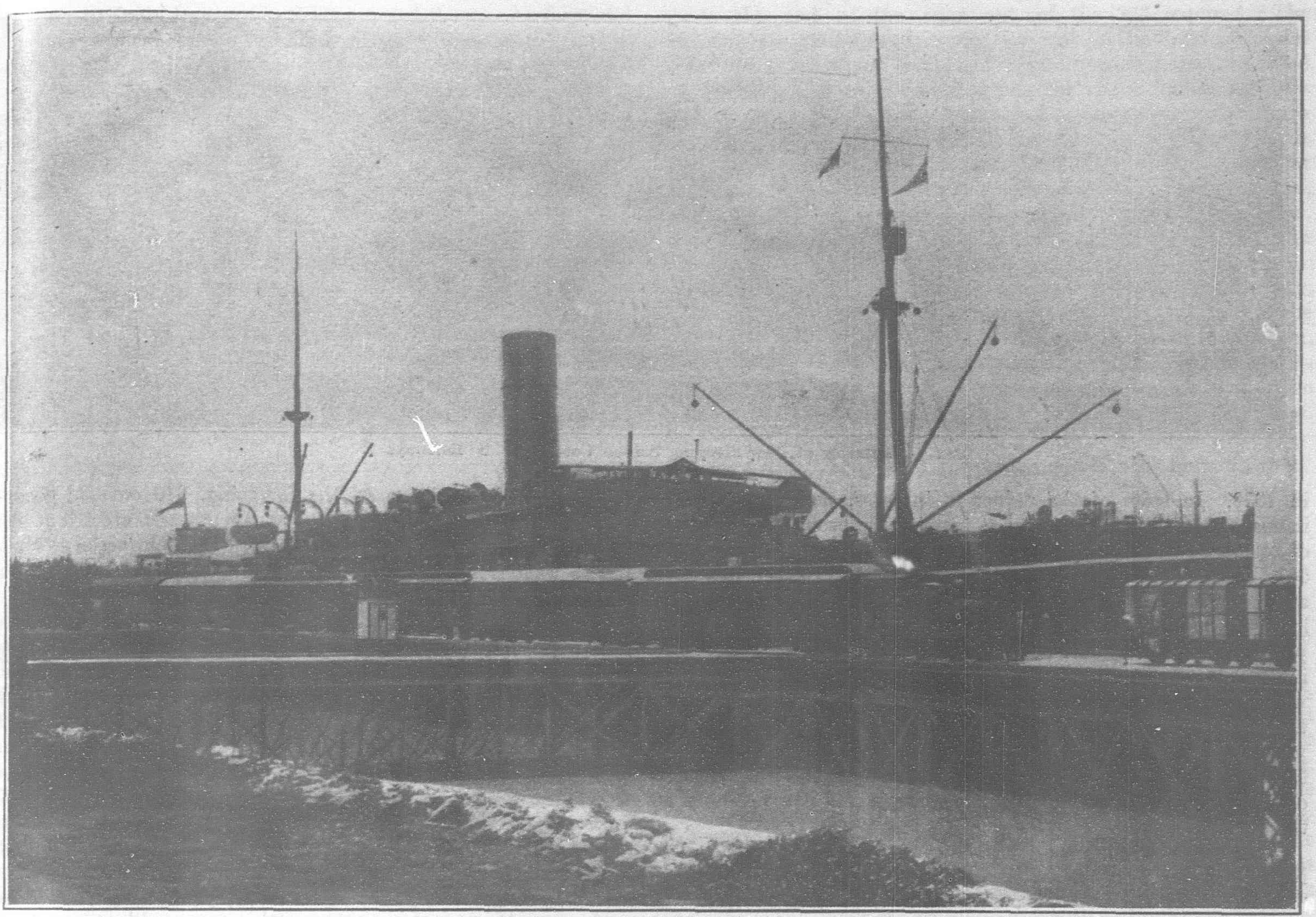
In addition to the furnaces at work near the mines, considerable numbers are owned by individuals who carry on custom smelting, receiving in payment the quicksilver collected in the annular space through the percentage holes. The ore treated in these furnaces in obtained from the mines or from the dumps, and not infrequently by theft. The owners of private mines have a set of furnaces for rich ore, and another for poor ore, and, if the miner strikes a rich pocket, the ore is treated in the rich-ore furnaces, the percentage holes being so inclined that the furnace owner receives about 40 per cent. of the total distillate as his share. This is an established custom to which the miners willingly conform —*Mining Magazine.*

Boosting Hongkong

HONGKONG is also waking up and getting ready for a big exhibition to be held sometime next year if present plans are carried through. The object of this exhibition, says the *China Mail*, is to bring more tourists to the colony and advertising the great trade facilities which Hongkong offered to merchants and also to exhibit the products of different provinces in China. Letters had been sent to the Chinese chamber of commerce soliciting information as to whether the Chinese would assist in the enterprise and the promoters of the scheme had discussed with its president, Hon. Lau Chu-pak, the question of formulating plans for this gigantic project which, he was confident, would not only yield untold benefit to local commerce but would be the means of giving prominence to the colony. The site of the exhibition, which covered an area of nine miles, would be selected in Kowloon.

A conception of the large scale on which the exhibition was to be held could be obtained from the size of the space required and it was the intention of the organizers to run it on such lines as would give them the result they desired.

There would be houses built to the same height and size and in the same style as genuine houses so that they could be inhabited by people during the time the exhibition was held. Then there would be railways, tramcars and motor cars in miniature, everything designed to fascinate visitors. The winter season was most desirable to hold the exhibition because rain in winter was scarce and therefore the articles exhibited could be preserved for a longer period. If the exhibition, which was to last several months, could attract people to Hongkong from all parts of the world, the colony would be benefited. No definite plans as yet been prepared, but it was expected that in February or April next year arrangements would be completed.



RAIL AND STEAMSHIP CONNECTION AT PORT SWETTENHAM

Federated Malay States Railways, 1920

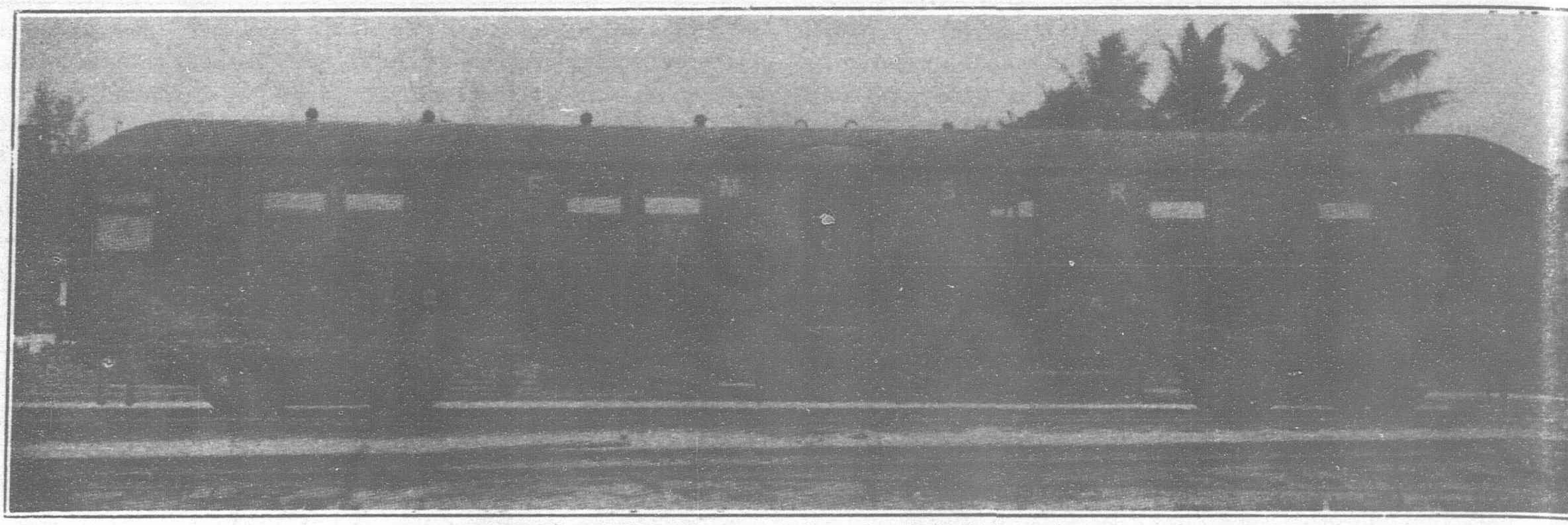
ACCORDING to the report of Mr. P. A. Anthony, M. Inst. C.E., the general manager of the Federated Malay States Railways, there was a net profit last year on the working of the lines under his charge of only £65,704. In other words, the earnings were only 0.39 per cent. on total capital expenditure. The figures compare with £386,218 and 2.67 per cent. respectively. The main factors contributing to the large decrease in profit were: *(a)* Increases in rates of pay and allowances to the staff; *(b)* increased cost of materials of almost every description used in railway working, whether locally produced or imported; *(c)* a corresponding increase in all branches of contract work; *(d)* and trade depression consequent upon the fall in price of rubber and tin.

The percentage of increase in the pay of the clerical service was from 56 to 90 per cent.; in the traffic-operating grades, from 80 to 106 per cent.; and to the monthly paid subordinate staff, 77 per cent. Furthermore, in addition to an increase of pay by 25 per cent., the daily paid staff were supplied with rice and bread at cheap rates, making in all an increase of about 60 per cent. Materials, stores and railway equipment show increases in cost from 50 to 500 per cent.

With a view of maintaining the railways on a paying basis, it has been necessary to increase the terminal charges pertaining to goods train traffic and to increase the rates for parcels and perishable traffic carried by passenger train. A ferry toll was introduced on traffic by the ferries between Johore and the island of Singapore: but a reduction in passenger fares from 50 to 25 per cent. above pre-war rates came into operation on January 1st, 1920, and there was an increase of 3,227,315 passengers carried. Passenger traffic by the through railway between the Federated Malay States and Siam increased during the year, but there was a falling off in goods traffic consequent on the suspension of the export of rice from Siam throughout the year. Stores and materials to the value of £1,031,420 were purchased during the year, representing an increase of £212,072, as compared with 1919. The tonnage in respect of the crown agent's shipments aggregated 7,785 tons, as against 2,267 tons in 1919, in addition to which 103 tons and 3,774 tons were received from Canada and Australia respectively.

The new line from Pasir Mas to Rantau Panjang in Kelantan, with a total length of 11 miles 37 chains, was opened on September 1st. The total mileage of running lines—reduced to single track—open on December 31st last was 1,014 miles 67 chains, including the Johore leased line, and of running lines and sidings 1,150 miles 71 chains. There are now 222 permanent stations and 24 flag stations or halts open for traffic.

The total capital expenditure to December 31st last was £16,815,706. During last year a sum of £2,386,156 was spent, of which £741,282 was in connection with the construction of new lines, £919,605 for widenings and additions, including new wharves, etc., at Prai and the Johore Causeway to connect Singapore with the mainland, and £419,795 for new rolling stock. Receipts from all sources amounted to £2,020,262, as compared with £1,745,037



Exterior of New Sleeping Saloon Coach, F.M.S. Railways

in 1919. In spite of the reduction in fares, passenger receipts increased by £183,907, and goods train traffic brought an increase of £49,033. The expenditure on all accounts amounted to £1,954,557. Under locomotive running expenses, very heavy increases are recorded, notably £102,309 for fuel, due to the insufficiency of local supplies, necessitating the purchase of coal at very high prices. The cost of fuel per engine mile increased from 28 cents in 1919 to 39 cents in 1920. The total running costs per engine were 64 cents for 1920, as compared with 46 cents for 1919. During the year 104 ocean steamers called at Port Swettenham with import cargo, as against 63 in 1919, and 60 ocean steamers called for export cargo, as against 32 in 1919. These figures are exclusive of the British India Company's steamers, which call regularly at the port.

Sixteen new "P" class locomotives were received from the North British Locomotive Works, Glasgow. Four "Q" class "Pacific" type locomotives, purchased in 1919 from the Baldwin Locomotive Works, Philadelphia, were also erected and added to the stock during the year, thus making an addition to the open-line stock of twenty new locomotives. Orders for forty new locomotives were also placed during the year—twenty "L" class from England and ten six-wheel coupled side tank locomotives from Baldwin Locomotive Works for the open line, and ten tender locomotives from the Baldwin Locomotive Works for the construction department. The open line stock of locomotives, including the steam rail motors, was 204, and of construction department locomotives twenty-two at the end of the year. The total engine mileage, including maintenance ballast miles, for the year under review was 5,666,121, as compared with 5,006,936 in 1919. The train mileage was 3,940,732, as against 3,463,405 in 1919. The average daily miles per engine actually at work was 108.6.

Thirty-two mail type bogie passenger carriages were newly built at the works and turned out to traffic, as against eighteen in 1919. One was a bogie sleeping saloon of a new design, with transverse berths instead of longitudinal berths, as in the old sleeping coaches, and all the eight double-berth cabins are of the same size. Twenty-one mail type bogie passenger carriages were under construction at the end of the year; 248 coaches of all types passed through the shops for heavy and light repairs, as compared with 226 in 1919. The total stock of bogie goods vehicles at the end of 1920 was 169, as compared with 132 in 1919. The construction of 47 bogie flat wagons was in progress at the end of the year; 374 wooden wagons were constructed at the central workshops. In addition to the foregoing, 340 covered goods—steel—were received from the Crown Agents and erected at Port Swettenham on contract by Messrs. D. G. Robertson & Co. These wagons are part of 500 steel covered goods ordered in England in 1919. Ten fish vans were in process of construction.

The total expenditure during the year on construction and surveys of new lines in the Federated Malay States, Straits Settlements, and Johore amounted to £1,661,088, as compared with £893,246 in 1919. Both in Kelantan and in Pahang progress was made towards the completion of the east coast railway, which will run from Gemas in the south of Selangor to Tumpat in Kelantan. The extension from Pasir Mas to Rantau Panjang, a distance of $11\frac{3}{4}$ miles, which joins the Siamese system, was opened for traffic in September last. After an interval of six years, work was recommenced on the Penang hills railway, and preliminary work begun on the Kuala Kubu deviation of $5\frac{1}{4}$ miles. The survey of the new line from Malacca to Gemas—$44\frac{1}{2}$ miles—was completed, and a survey was under progress with a proposed line from Kuala Krau to Kuantan, in Pahang. The lines from Kuala Lumpur to Port Swettenham, from Batu Junction to Kuala Lumpur and Sungei Besi, and from Woodlands to Fort Canning (Singapore) are to be doubled, and the work was under way at the date of the report. New engine and carriage sheds and a goods yard were under construction at Ipoh, in Perak, and considerable progress had been made with the additional goods and marshalling accom-

Construction of the F.M.S. Railway Causeway between Johore Bahru and Woodlands. Site of Lock, Looking East modation at Kuala Lumpur, in Selangor, and the new carriage and engine accommodation at Seremban, in Negri Sembilan. A contract for the erection of six godowns—warehouses—at Teluk Ayer Reclamation, Singapore, was let to Messrs. Robert Young & Co., Penang, the price being £166,063. The Federated Malay States Railways are constructing departmentally a reservoir and dam at Bukit Serayah, about 11 miles from Prai, for the supply of water for Prai and Bukit Mertajam. On that work £33,845 was spent during the year. Two of the largest pieces of work in hand are the reclamation of the foreshore and construction of wharves and godown accommodation at Prai, province Wellesley, opposite the island of Penang, and the construction of the causeway across the Straits of Johore to connect the island of Singapore with the mainland, and provide for a double line of rails and a motor road. Both contracts are being carried out by Topham, Jones and Railton, Limited. Good progress was made with the jetty at Prai, 213 of the concrete cylinders being sunk up to the end of the year out of the 323 required. The cylinders are all founded in the layer of coarse sand at about 53-ft. below low-water level, and have all passed the prescribed loading test. The concrete hearting for the cylinders and the mass concrete capping beams are being proceeded with, and a start has been made with the reinforced concrete decking. It is expected that about 850-ft. of jetty will be opened for traffic at the end of the present year. The supply of labor is plentiful, and 52 Europeans and 2,000 Asiatics are employed on the works. The value of the work done at the end of 1920 was £431,650, or about 38 per cent. of the whole contract.

Good progress was made with the work on the Johore causeway. The construction of the lock at Johore was well advanced, and the north wall of the lock was about one-half completed. In addition. the first two lengths of the east and west wing walls were built, The eastern portion of the water-tight cofferdam enclosing the south wall of the lock was ready for closing at the end of the year.

Penang Hills Railway

THE following is an abstract of a paper presented to the Engineering Association of Malaya, by Mr. A. R. Johnson, resident engineer, Penang hills railway, on the occasion of their inspection of the railway on September 24th, 1921.

The conditions governing the lay-out and equipment of a steep cable railway are entirely different from those obtaining in the case of an adhesion or rack line. In laying out the later, after the general route, ruling gradient, and minimum curvature have been decided upon, considerable elasticity is permissible, in the detailed location, and the surveyor in running his trial lines, can go back upon his route and modify it if he finds himself getting into too difficult country. The location of any particular portion of the line is independent of that of any other portion and tangents, curves and gradients may be combined and succeed each other in an endless variety of ways.

In a well-designed cable line, any portion is not only dependent upon those which immediately precede and follow it, as in an adhesion line, but upon the whole lay-out from beginning to end, and it is impossible to introduce local deviation either in gradient or planimetric position without affecting the entire location of the line.

This stringent condition of design will be clear from the following considerations. The cars are not self-propelling, but connected by the haulage rope, hence their motion is interdependent. The haulage rope has to be moved as well as the cars, and its weight may be as great as that of the cars themselves.

The theoretically correct profile consists of a parabolic curve of which the variation in gradient is such that the tractive effort to be exerted by the hauling engine is a constant. It is, of course, advisable to avoid horizontal curvature as in an adhesion line, as far as possible, but the introduction of such curvature even in a marked degree, does not involve any serious interference with the theoretical efficiency of the line, if the correct profile is maintained.

How the Cars Work

The arrangement of the cars and the position of the haulage engine on this line are those generally adopted on modern lines of the type. The haulage engine is placed at the top of the line and there are two cars attached to either end of the haulage rope, which is led up the line from one car, over the drums of the engine and thence down the line to the other car. In this case the line is divided into two separate and independent sections but as they are both identical in principle, I will consider only one section.

Let us call the ascending car A and the descending car B. The cars pass each other at the middle of the line. If car A is at the bottom and car B at the top, it is clear that the engine has to haul up the rope to which car A is attached in addition to the car, and that as the car ascends this load continually decreases. The portion of the rope attached to car B is similarly continually increasing. When the ascending car A is below the middle point of the line, the weight of the portion of the rope between the positions of the cars at any moment is acting against the engine, as the two ends above the upper car are equal in length and mutually balance.

When the ascending car has passed the middle point, the descending rope is the longer and the weight of the difference in length of the top ends is assisting the engine. When the cars pass each other at the middle point, the load due to the weight of the rope vanishes as both ends are the same length.

From this it is clear that if one could have a weightless rope, in order that the tractive force might be a constant, the line would have a uniform gradient throughout, and the tractive force exerted by the engine would depend only on the difference in the weights of the cars. But as a weightless rope is impossible, in order to keep the tractive force constant, it is necessary so to design the profile that the difference in the load due to the cars varies in a ratio dependent upon the varying ratio between the rope ends.

From this general outline of the problem, it will be clear that the location has to be considered as a whole, and that it would be a waste of time to attempt to lay out a trace in the usual way by trial lines run from some selected starting point without any knowledge of the ground in front.

Locality of Line

The most suitable locality for the line had first to be determined. The conditions governing this selection were that the slope of the hill chosen must be a comparatively short one and uninterrupted by isolated summits, that the starting point of the line must be as near as possible to a main road, and that the upper terminus must be at a point easily accessible from the existing roads and buildings on the hill. The portion of the hill-side which lay within this general area was then surveyed.

I found the whole slope of the hill extremely broken and uneven. Precipitous faces of rock, some of great height, were common on the upper slopes, while the lower were intersected by numerous gorges filled up with boulders of all shapes and sizes; one which the line crosses on a viaduct I estimate to weigh over twelve thousand tons. About sixty different locations were investigated before the final one was decided upon.

The line is in two separate and independent sections, both of which have a theoretically correct parabolic profile. Horizontal curvature had to be introduced on both sections; that on the lower consisting of a short curve of fifteen hundred feet radius at the bottom. There are two curves on the upper section, the radius of the sharper of the two being also fifteen hundred feet.

It would have been possible to obtain a location in a single section, but to have approximated to the best conditions, it would have had to have had a great deal of horizontal curvature, very high viaducts and probably several tunnels; it would have been more costly to build, work and maintain, and its carrying capacity would have been less than that of the location adopted.

The total length of the line measured along the formation level is one mile 435 yards. The mean gradient is slightly less than 1 in 3 and the maximum 1 in 1.93. The centre of the upper station is 2-381 feet above mean sea level.

Foundations and Cars

The whole line is carried on masonry throughout, the track being built into the masonry and anchored by long bolts at suitable intervals.

The rails are of a special section with a wedge-shaped head, to provide a suitable grip for the car brakes.

The viaducts are built of masonry with concrete arches, and there is a tunnel 86 yards long on the upper section close to the top of the line.

The cars are each capable of carrying about 40 passengers, and as one trip can be made every quarter of an hour, the maximum carrying capacity of the line is about 160 passengers in each direction per hour. They are built to the mean gradient of the line, and are divided into four compartments and two end platforms for the car attendant; all of which are stepped one above the other so that the floors are level.

Each car is fitted with three emergency brakes, two of which are automatic and each of which is capable of pulling up the car fully loaded on the steepest gradient in a distance of five to six feet. Each brake consists of a pair of forged steel jaws which grip the specially shaped rail head.

Special provision is being made for dealing with goods traffic in loads up to about 2½ tons, to permit of an economical development of the hill.

The motive power of the line will be electricity which will be obtained from the municipal power station at Penang. The haulage engines will be fitted with all necessary safety devices.

A special signalling installation will be provided, to ensure that both cars are ready before the driver starts the engine, and to permit of the car men despatching signals to the driver from any point of the line.—*Penang Gazette.*

Prai Water Supply

ON the occasion of the visit of the engineering association of Malaya to Penang recently, when inspections of the various public works on the island, and in Province Wellesley, were made, several very interesting, if highly technical, papers referring to the works inspected were read.

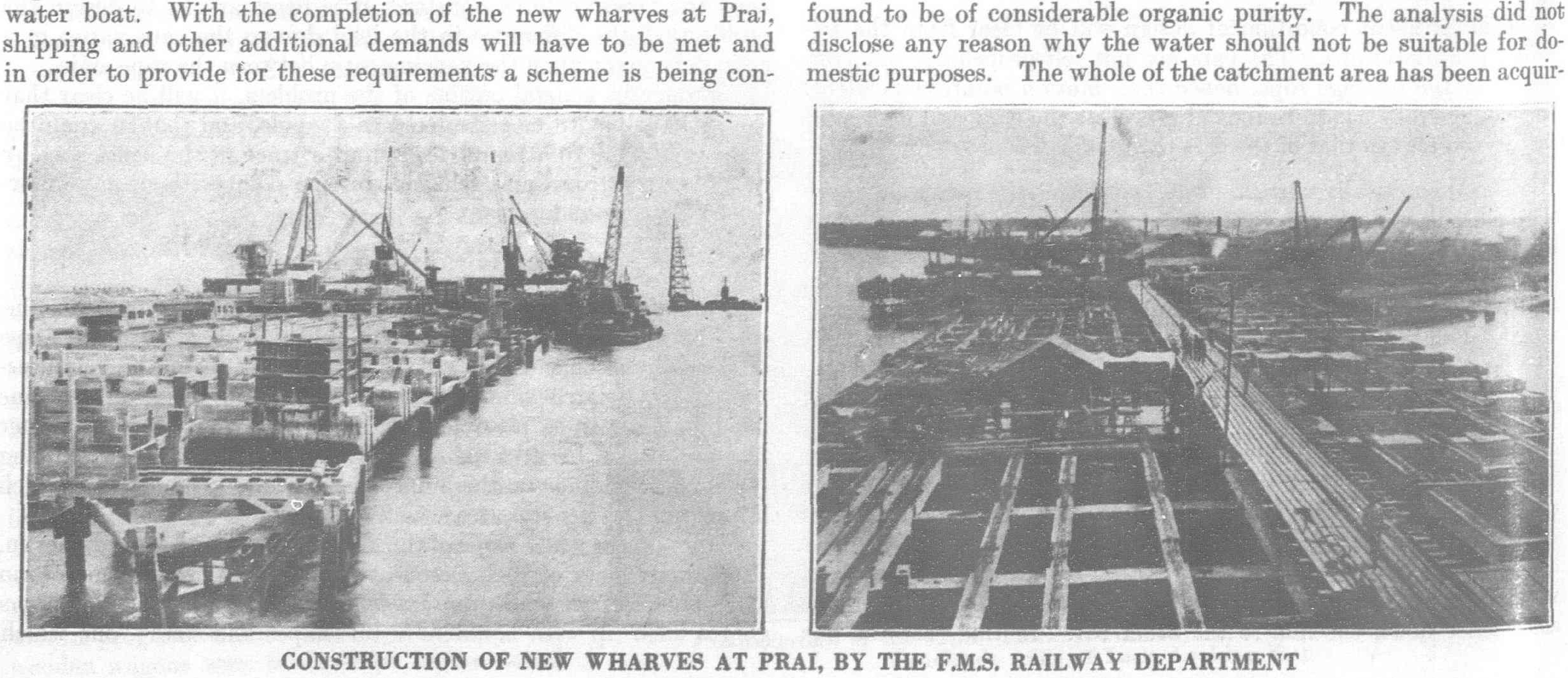
The first inspection was carried out at Bukit Serayah on Friday morning, September 23, where the new works in connection with the Prai water supply are being constructed under the supervision of Mr. D. W. Brisbane, section engineer, F.M.S. Railways. Prior to the inspection, Mr. Brisbane read a paper to the members explaining the scheme, a resume of which is given below:

At the present time Prai does not possess a sufficient water supply, and practically all the water required by the railway department and other large users, is obtained either by rail or water boat. With the completion of the new wharves at Prai, shipping and other additional demands will have to be met and in order to provide for these requirements a scheme is being constructed which comprises a masonry dam and storage reservoir at Bukit Serayah, a pipe line to Prai and an elevated storage tank and service mains at the latter place, designed to supply 500,000 gallons per diem.

Catchment Area

The catchment area is situated on the southern slope of Bukit Serayah and covers 217 acres. It is considered that the rainfall at Bukit Serayah is not less than at Parit Buntar, and a mean annual precipitation of 95.7 inches, and a minimum of 65 inches have been assumed for the catchment. In a year of minimum rainfall, the total yield from 65 inches would be 319,000,000 gallons which would give an estimated run-off of 185,000,000 gallons.

The water was submitted to a chemical and physical examination by the institute of medical research, Kuala Lumpur, and was found to be of considerable organic purity. The analysis did not disclose any reason why the water should not be suitable for domestic purposes. The whole of the catchment area has been acquir-



CONSTRUCTION OF NEW WHARVES AT PRAI, BY THE F.M.S. RAILWAY DEPARTMENT ed, and all dwellings are being removed or destroyed in order to avoid all risk of contamination.

Reservoir

The minimum annual run-off available for storage is estimated at 185,000,000 gallons. Evaporation and absorption are expected to amount to 35,000,000 gallons, leaving a gross amount to 150,000,000 gallons. Deducting from this figure, the quantity in the bottom of the reservoir which cannot be drawn off, the nett available supply is 147,000,000 gallons. The reservoir has been designed to have a capacity of half this amount, and the actual nett capacity of the complete reservoir will be 72,000,000 gallons. This is enough for 4½ months' supply at the maximum daily draft of 500,000 gallons. The surface area of the full reservoir will cover eleven acres.

The Dam

Perhaps the most interesting part of the work is the dam, the site of which is situated below the junction of two small streams and between two fairly steep spurs. Below this site, the valley falls very quickly. The dam, which is of the gravity type, will be constructed in cement concrete. The maximum height from toe to spillway level at any section will be about 80 feet, and the maximum available depth of water when the reservoir is full will be 55 feet. The total crest length will be about 450 feet, including a spillway of 60 feet wide. The coping of the spillway will be 424 feet above rail level at Prai station. The foundation of the dam is granite, but unfortunately a large fissure about 30 to 40 feet wide, extends across the site, and runs approximately parallel to the general direction of the valley. The fissure is now being excavated, and has reached a depth of about 50 feet below the original surface. The government geologist has examined the site. He reports that the extent of softening is not unusual.

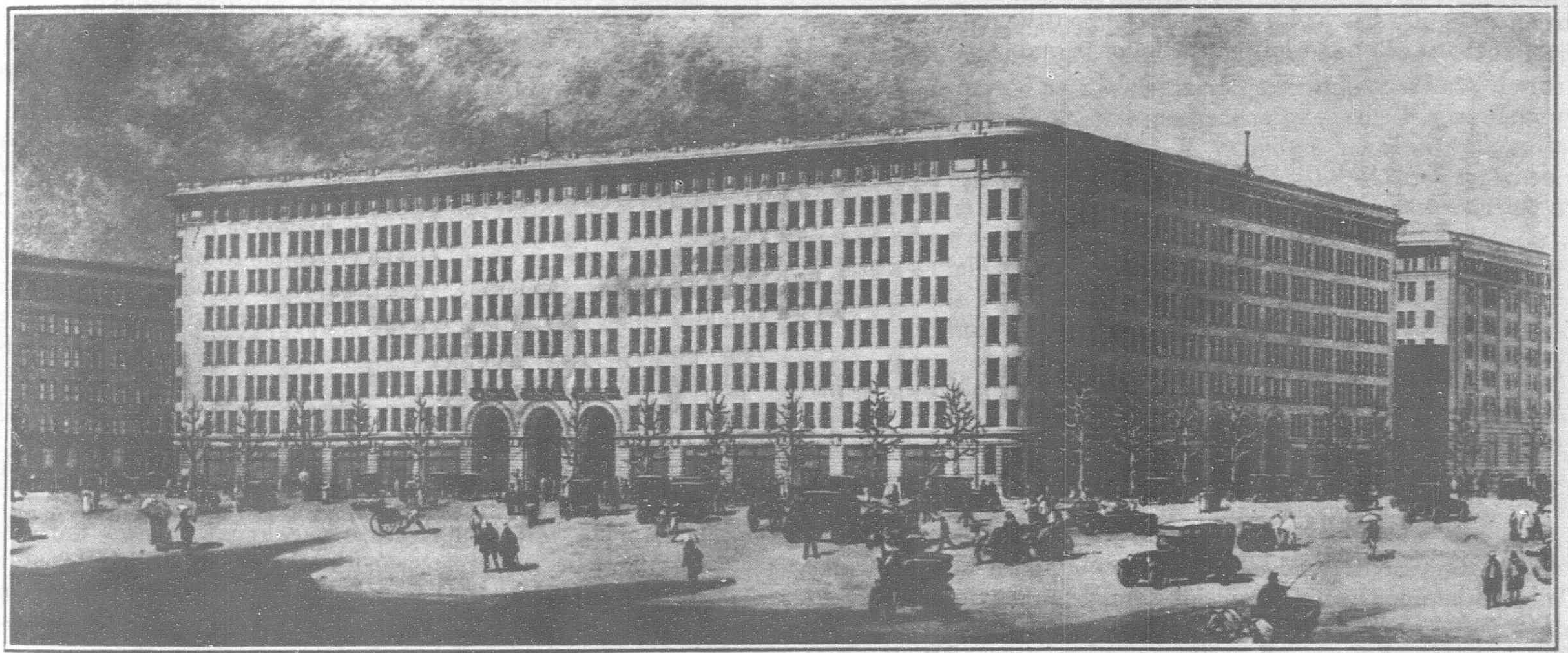
Draw-Off Tower

The draw-off tower is to be built of concrete with cast iron lining and fitted with four 10-inch diameter intake valves and a 24-inch sluice valve. A grating and 40-inch flap valve will admit the water to the sluice valve and a tunnel through the dam will carry the 10-inch supply main through the dam from the draw-off pipe. A 10-inch cast iron main will convey the water to Prai, 10½ miles away, and is calculated to deliver 38,000 gallons per hour.

Storage Tank

The elevated storage tank proposed, will consist of three cast iron tanks, capable of being used singly, in pairs, or together. The tanks will have a capacity of 110,000 gallons, and will be supported on reinforced concrete columns 50 feet high. The foundations will be piled.

The paper concludes with a detailed description of construction, transport and supply of water to shipping. It is suggested that a place where water boats can fill up should be provided and thus reduce the number of water boats required.



The new Mitsubishi Office Building in Tokyo now under construction by the George A. Fuller Company of the Orient. At the right is seen a corner of the new Nippon Yusen Kaisha Building also being constructed by the same company.

Asia's Largest Building

THE largest office building in Asia is now being erected in Tokyo for the Mitsubishi Company on a site immediately facing the central railway station. The contract is being carried out by the George A. Fuller Company of the Orient, a subsidiary of the American firm who erected the Flatiron Building in New York. The cost is estimated at seven to eight million yen. It will be used for offices and consist of eight stories on an area of 350 by 300 feet. The building will be of steel, reinforced concrete floors, with a buff colored facing tile or brick. The inside will be finished in tile, marble and stone, making a complete fireproof structure.

In addition to the above, the Fuller Company will erect a modern office building of seven stories with 300,000 square feet of floor space for the Nippon Yusen Kaisha to cost approximately Yen 5,000,000. The site of this building is immediately behind the Mitsubishi Building and facing the Kaijo Building. The third contract is for the erection of a seven-story building for the Nippon Oil Company to have a floor area of 200,000 square feet and will cost about Y.3,500,000. Work on the Mitsubishi Building is proceeding apace now that the initial difficulties have been overcome, and by the end of December the contractors expect that the entire steel work will be erected and the walls well under way, and opened to occupancy by the end of 1922.

Undoubtedly one of the most ornate and imposing buildings in Asia has just been completed for the home of the Mitsubishi Bank in Tokyo, at a cost of Y.3,000,000. It is entirely of white granite, covering 800 *tsubo* of ground.

Italian marble and polished granite will form the basis of the interior finish. The banking room is to be finished in American terra cotta and polished granite.

Locomotive Development on N.E.I. Railways

(A Paper compiled at the offices of the State Railroads and Tramways of the Netherlands East Indies)

A CLEAR idea of the enormous increase in transport and traffic on the railroads and tramways in Java between the years 1894 and 1919, may at a glance be obtained from the figures in the table given below.

	1894	1919
Proceeds from transport of passengers in *millions of guilders*	2.54	22
Proceeds from transport of goods ditto, ditto	4.75	28
Number of passenger-kilometres in millions of kilometres	167	1800
Number of vehicle-kilometres in ditto, ditto	78	1150

This rapid growth in the last 25 years dating from the completion of the first railway-connection between Batavia and Sourabaya, naturally has had a great effect upon the nature of the rolling-stock, as will be seen from the following table :—

	PROCEEDS.							
YEAR	Passenger Transport millions of Guilders.	Goods Transport millions of Guilders.	No. of Engines.	Weight of heaviest engine.	No. of Carriages.	Weight of heaviest carriage.	No. of cars.	Capacity two-axled cars in tons.
1894	2.545	4.73	206	33 tons	444	10 tons	2419	8
1919	22.	28.	568	133 tons	1687	40 tons	11274	12

LEVEL LINE LOCOMOTIVES

1 B-Fox Walker Tender Engines

The first seven tender engines were supplied by Fox Walker Co. of Bristol for hauling trains of 125 tons on maximum gradients of 10 per cent. and with curves of 150 metres minimum radius. They are now being used on the tramways in the Madioen-Residency.

1 B-Linden Tender Engines

In 1886, eleven engines were supplied for the Djocja-Tjilatjap line by the Hanover Maschinenbau Aktien Gesellschaft, intended for passenger-trains on gradients of $\frac{1}{120}$ to $\frac{1}{100}$ and with curves of 150 m. minimum radius. These engines are now used for shunting, and on stretches where traffic is moderate.

1 B-Twin Cylinder Engines with Two-axled Tender

The 1 B engines with two-axled tender, made by Sharp Stewart & Co., of Manchester and Glasgow, have played an important part. They are typically English, very simple and sound in construction. The first ones were put into use in 1880, whilst the last ones of the series were bought in 1896. They have a driving-wheel diameter of 1412 millimetres, and haul mixed trains of 160 tons on maximum gradients of $\frac{1}{50}$ and curves with a minimum radius of 250 m. on free stretches, at an average speed of 40 kilometres an hour.

It is striking how afraid people were at that time, lest the position of the boilers should be too high. This can be observed from the older specifications where we find the injunction the centre of the boiler to be as low as possible and not higher than 1.68 metres above top of rail. The need of stoking with inferior kinds of coal was, however, immediately foreseen, and in addition to a large grate-area, a large heating-surface of the fire-box was also provided for. The boilers were originally fitted with brass tubes which have been replaced in the last ten years by iron ones. Before the arrival of the 2-B compound passenger-train engines, the 1-B engines had also to draw fast trains at a maximum speed of about 60 km. an hour, for which purpose 12 of them were provided with vacuum-brakes. At present they are exclusively used for mixed trains and a few passenger-trains with a maximum weight of 210 tons at a maximum speed of 45 km. an hour on level roads or a maximum of 180 tons at an average speed of 35 km. an hour on gradients of 5 per cent., for instance, on the divisions Wates-Djocja and Batavia-Merak.

When the train-service became heavier (at present practically all the engines work at full load) the frame had to be considerably strengthened transversely. The renewal of the old boilers on account of defects in the rivet-seams, first gave rise to an examination as to whether it would not be advisable to provide the engines with *larger* new boilers. When it appeared that a larger boiler would involve very great alterations, it was decided to make a few new boilers suitable for super-heated steam whilst retaining the former chief dimensions, with the old working tension of 10 k.g./cm^2, so that the appendages might remain unaltered. The amount of transformation of the engines has thus been reduced to a minimum and when it is carried out, they will be fitted with Friedmann lubricating-pumps and balanced slide valves.

The application of super-heating (Schmidt system) will considerably increase the capacity both of boiler and engine, so we may expect that the 1 B Sharp Stewart type of engine will for a long time remain one of the very useful and practical traction units.

Now that they are being gradually crowded out of Java they can in future in Sumatra and the other out-lying parts of the colonies, render the same services which have been so profitably rendered in Java up till now to such a great extent.

The number at present in use is over 65.

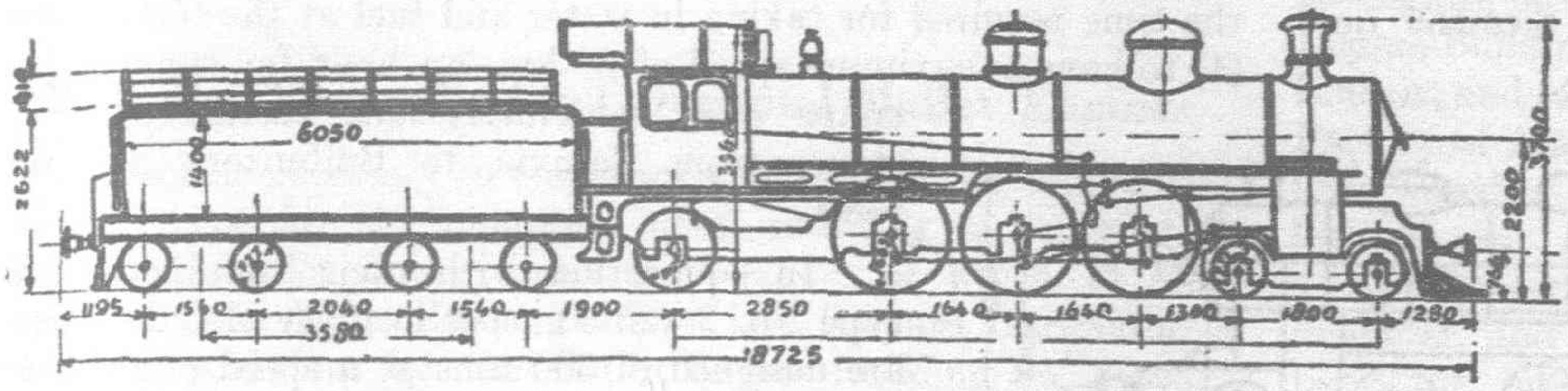
2 B Passenger Train Engine with Compound 3-axled Tender

When, towards the end of last century, it was foreseen that the express passenger traffic would demand a speed of more than 60 km. an hour, it was deemed advisable to employ bogie-engines. The type chosen was the 2 B type, 44 of which were purchased from 1900 to 1910; 26 from the Hanover Engineering Company at Linden, 10 from the Netherlands Engineering and Rolling Stock Manufacturing Works at Amsterdam, and 8 from the Saxon Engine Works formerly Richard Hartman Co. at Chemmitz.

The engines are built for hauling trains weighing 130 tons at a maximum speed to 60 km. an hour on free stretches with curves of 250 metres radius, and gradients of 5 per cent. and are fitted with vacuum brakes. They are chiefly used for running mixed trains at a maximum speed of 45 km. an hour and passenger trains at speeds of about 60 km. an hour. The weight of the mixed trains average 350 tons on level lines.

2 B-Passenger Train Super-heater Engines with 3-axled Tender

To keep pace with the rapid increase in weight of fast trains during the period from 1900 to 1910, it became necessary to procure an engine to meet the heavier demands and run more smoothly at high speeds, the 2 B type with Schmidt super-heating system was adopted. In practice, the difference with the saturated steam engine comes to 50 tons more train load for mixed and 40 tons more for fast trains. They are at present serving on the Weltevreden-Buitenzorg and Weltevreden-Tjikampek-Cheribon divisions, at maximum speeds of 75 km. an hour, when relieving lost time.

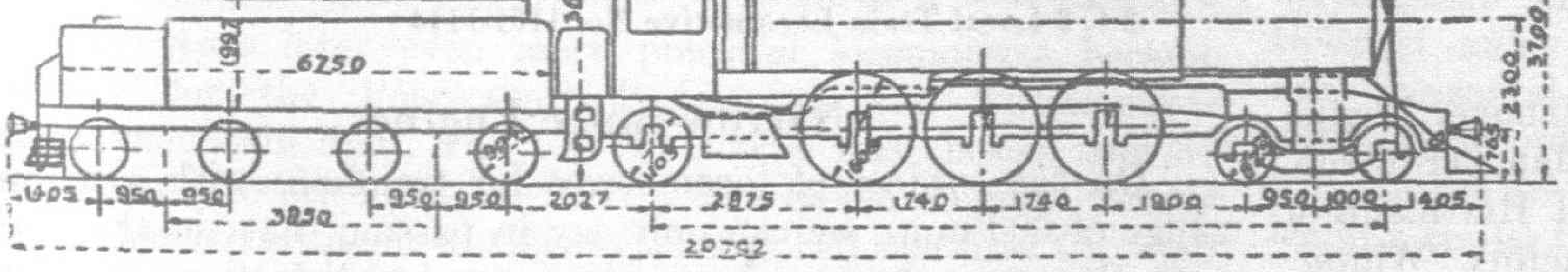


2 Cl. Express Locomotive No. 701-716 with overheater

2 C 1 Two-Cylinder Super-heater Express Engines with 4-axled Tender

The extraordinary increase in the long distance express passenger traffic induced the design of a more powerful type of engine of whose axles three at least had to be coupled on account of the permissible axle loads. The necessity of extending the large grate transversely, it having already reached considerable length, rendered it impossible to locate the fire-box between the frame-plates, so an Adams radial rear axle became indispensable.

These engines are designed for hauling a train of 300 tons at 33 to 35 per cent. admission maintaining a speed of 65 km. an hour on gradients of 5 per cent. combined with curves of 250 metres radius or the same train-load at a speed of 80 km. an hour on the level. During the years 1911 to 1914, sixteen of these engines were put into service ; 7 were supplied by the Swiss Locomotive and Engine Works at Winterthur, and 9 by the Saxon Engine Works formerly Rich. Hartmann Co. at Chemnitz.



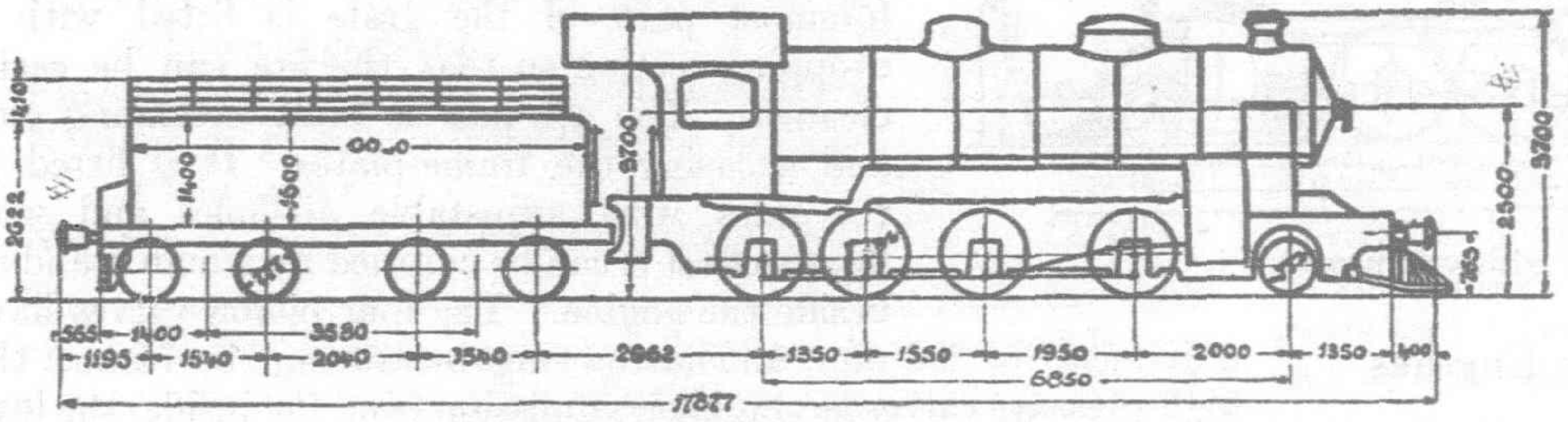
2 Cl. Compound Express Locomotive No. 1001-1012

2 C 1 Four-cylinder Compound Super-heater Express Train Locomotives with 4-axled Tender

The one-day service between Batavia and Sourabaya demands a type of locomotive still more powerful than the 2 C 1 two cylinder engines, in order to increase the maximum allowable speed to *100 km. an hour on the level.* Because two large outside cylinders would injure the quiet running at high speeds and furthermore on account of the great difficulties (imposed by the limited axle-load of 12 tons on rail type No. 3 weighing 33, 4 k.g. a metre) to get the required largest available amount of power, it became quite necessary not only to apply super-heating, compounding and feed-heating but also to use more than two cylinders, so the four-cylinder type with inside H.P. and outside L.P. cylinders was chosen. The engines were designed in 1915 ; 16 for hauling trains of 300 tons at a speed of 70 to 75 km. an hour on gradients of 5 per cent. and at 100 km. an hour on level parts of the track, or for trains of 400 tons weight at a speed of 90 km. an hour on horizontal lines. The capacity necessary for these performances would amount to about 1200 I.H.P. with an adhesive weight of 35 tons. During 1919 twelve engines supplied by the Netherlands Engineering and Rolling Stock Manufacturing Works at Amsterdam, were put into service for hauling the express-trains between Batavia and Sourabaya, which often weigh 400 tons on the Batavia-Cheribon division. The engine-frame consists of a combination of plate-frame and bar-frame, which latter form had to be used on account of the cylinders, as these are all four mounted side by side at the same height. The boiler, whose centre-line lies 2300 mm. above the railtop, is fitted with 19 flues of 124/133 mm. diameter, containing super-heater tubes system Schmidt, fit for super-heating to 350 degrees Celsius steam of 14 k.g. per cm.^{2} pressure. An automatic damper is placed in the extended smoke box. The super-heater elements have welded joints. The foremost part of the grate is fitted with a dropping section so that the fire can be easily cleaned. The ash-pan is built extending over and encasing the frame-plates. It is fitted at the sides with adjustable air-holes and with flaps so that it can be emptied by a man standing beside the engine. The four piston valves have a diameter of 200 mm. and narrow rings measuring 6 by 7 mm. ; the high-pressure valves having their admission from the inside, the low-pressure piston-valves have double admission on the outside. The L.P. valves are moved by a Walschaert gear, whilst the H.P. derive their movement from the same mechanism by means of a secondary shaft and two cranks. The L.P. cylinders have an automatic bypass, fitted with a valve, which is closed and remains so, whenever fresh steam is admitted into the H.P. steam-chest exerting a pressure on one side of the valve.

When running with closed throttle, this bypass valve is pushed open by the compression of the cylinder. Engines No. 1001 and 1002 are fitted with a three-way cock instead of a draw-gear. etc., by means of which the driver, during the start and whilst running with closed throttle, can open the bypass of the H.P. cylinders, thereby opening a communication between the ends of the H.P. cylinders. When running under steam, on the other hand, the largest surface of the bypass valve is subjected to live steam pressure and interrupts the communication. In the case of engines No. 1003 to 1012, the three-way cock, etc., are replaced by ordinary bypass valves for the H.P. cylinders, which are manipulated by the driver. The cylinder-covers are fitted with self-adjusting stuffing-boxes, Schmidt system. The feed-heater, system "Knorr" with feed water pump, consists on account of the restricted space of two halves placed in series, each of 7 m^2 v.o. The pump has a capacity of 120 litres an hour. In addition to this pump, the engine has also a non-lifting Friedmann-injector, class A. S. Z. No. 9. The feed-heater receives apart of the exhaust steam, the exhaust steam from the vacuum-brake-ejector and from the feed-pump. An automatic arrangement for the feed-heating prevents the feed-pump from pumping cold water into the boiler by admitting extra steam into feed-heaters from the boiler when the engines stands still.

In consequence of the high maximum speed of 100 km. an hour, the following items have been selected with great care, namely: the height of the centre-line of boiler above rail top, viz., 2300 mm., the diameter of the driving and coupled wheels at 1600 mm., the diameter of the engine truck wheels at 825 mm. and the axle-journals of same (130 by 250 mm.), whilst in addition to the complete balancing of the rotary parts 40 per cent. of the reciprocating parts are counterbalanced by weights divided between the wheels of the driving and coupled axles. The driving-axle (which is at the same time the first one of the coupled-axles) has crankwebs according to the Frémont system, as a safety-measure against injurious irregularities in the materials strains and stresses. The connecting-rods or main rods are provided with a strap at the big end. The coupling-rod has got fixed bushings which are pushed by hydraulic pressure into the rods. All the metals are lined with babbitt. The mild-steel pedestals or hornplates of the driving and coupled axles have no adjustable wedges or horn-blocks. The journal boxes of wrought mild steel are lined with babbitt on their guiding faces. Further special features are the following: self-registering speed recorders system Hasler, vacuum-brake with ejector of the "Dreadnought" type, steambrake, handbrake (only for the fender) sanders "Gresham and Craven," Zara-throttle, Klinger gauges, safety valves system "Coale" receiver-safety-valves blowing off at 7 k.g. per cm²., anti-vacuum valves, smoke-consumers system "Marcotty" with flap door fire-brick arches, Friedmann lubricating-pumps, thermo-electric pyrometers system Siemens and Halske, tenders with long filling lids Gölsdorf design.



1 D Freight Locomotive, No 901-929

1 D Goods to Locomotives for Level Lines Twin Cylinder Super-heater Engine with 4-axled Tender

When the 1 C twin and compound engines were superseded by others on the principal mountain lines for a long time shay did duty as goods engines on level lines with gradients of 0 to 5 per cent. until the weight of these trains increased to such an extent that it became regularly necessary to use double traction. This was the case, amongst others, with the "sugar-trains" on the divisions Madioen-Sourabaya and Koetoardjo-Tjilatjap, whilst on the Meester Cornelis-Tjikampek division the traffic gradually became so heavy as to reach beyond the capacity limit of the 1 C engines.

For this reason, a powerful type of goods-engine for use on level lines was ordered, having a separate tender and four coupled axles. Six of these engines were supplied by the Hanover Engine Manufacturing Co., Ltd., late George Egestorff of Hanover-linden. Six by the Saxon Engine Factory, formerly Eichard Hartmann of Chemnitz, 12 by the Swiss Locomotive and Engine Factory "Winterthur," and 5 by the Amsterdam Engine and Railway-material Factory. The 29 engines were put into service during the years 1914 and 1915. They are designed for a maximum speed of 50 km. an hour, for curves with a minimum radius of 150 metres, allowing 29 mm. enlargement of gauge, and for those with a minimum radius of 120 metres, having 30 mm. gauge enlargement.

The engines are at present being used on various divisions with maximum gradients up to 5 per cent., and on which maximum train loads of 800 to 1,000 tons are transported (in the case of night goods trains up to 1,400 tons), whilst on the Batavia-Buitenzorg division, on those parts with continuous gradients of 12.5 per cent., mixed trains can take 350 tons in good weather (the maximum is 280 tons for faster trains). In the fast-train service, speeds of about 60 km. an hour are reached; for want of powerful fast-train engines, the 1 D locomotives have temporarily been hauling fast trains also on the Batavia-Buitenzorg division. They are also suitable for service on mountain-lines where the gradients are not too steep, for instance on the division Poerwakarta-Padalarang, therefore they form a useful reserve for occuring double traction at dividing stations where mountain and level lines meet.

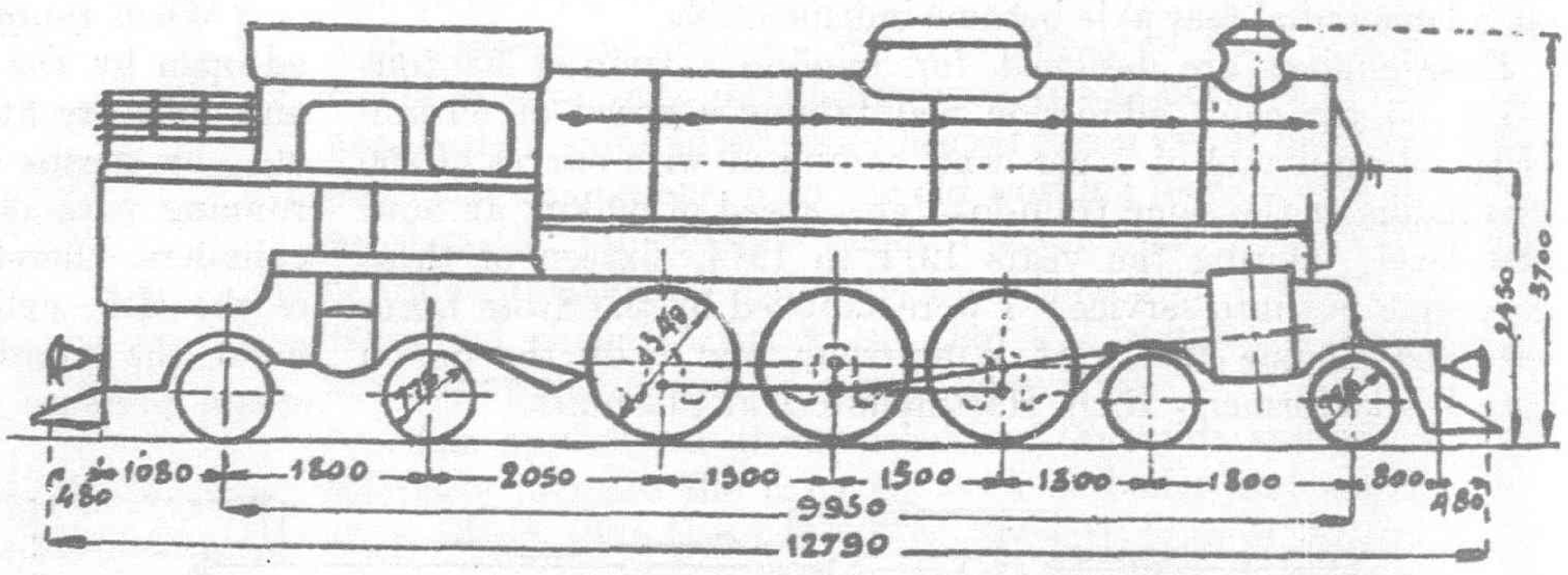
They have proved themselves to belong, within fairly wide limits, to the most efficient types of modern engines.

2 C 2 Twin-cylinder Tender Super-heater Engines

In order to cope with the heavy traffic on the Batavia district railways in an up-to-date manner, special tender-locomotives were ordered in 1916, which had to fulfil the following principal specifications :—

(1) to start and to stop quickly and often; (2) to be able to run backwards quite as well as forwards, in order to prevent waste of time in turning at the termini; (3) to be able to carry the largest possible supply of water and fuel, so as to reduce to a minimum the time required for taking in water and fuel at the termini and (4) to have a maximum speed of 80 km. an hour for running fast trains over moderately long distances, for instance from Batavia to Buitenzorg and *vice versa*.

In connection with their running on rail type No. 2 (25 kg. per m.), the 2 C 2 engines are designed of 300 tons at a speed of about 50 km. an hour for serving trains with an adhesive weight of 33-ton on gradients of 5 per cent. and on curves having a radius of 180 m. with 20 mm. gauge enlargement. The normal speed on the level amounts to 60 km. an hour. Furthermore the engines will have to be able to take without difficulty curves having a radius of 125 m. with 20 mm. enlargement of gauge. These engines were supplied by the "Swiss Locomotive and Engine Factory", at Winterthur.



2 C 2 Local Train Locomotive No. 1101-1114

Narrow-gauge Engines

On the subject of locomotives for tramlines with a narrow gauge of 600 mm., we can only say in passing that the C engines with flue super-heaters have given great satisfaction, and that the powerful D engines for the same gauge are partly constructed on the "Klien-Lindner" principle with hollow driving-axles, and the rest are provided with two "Gölsdorf" axles in both cases the front and back coupled axles to allow for easy running through sharp curves.

MOUNTAIN LOCOMOTIVES

C Fox Walker Tender Engines

The first three mountain engines were supplied by Fox Walker & Co., of Bristol, for the building of the Sourabaya-Pasoeroean-Malang line in 1878. They are designed for running light trains on mountain lines with maximum gradients of 40 per cent. and on curves having a minimum radius of 100 m. They are only used now as shunting-engines in one or another of the large harbor yards.

1 C Twin-cylinder Tender Engines

When a beginning was made with the construction of railways on a large scale in West Java it became necessary to order a type of engine destined for the future regular service. The Saxon Engine Factory (late Richard Hartmann Co., Ltd., of Chemnitz) supplied a very sound and simple type of engine which is still rendering excellent service. In the course of the years 1879 to 1891, forty-eight of these engines have been put into service.

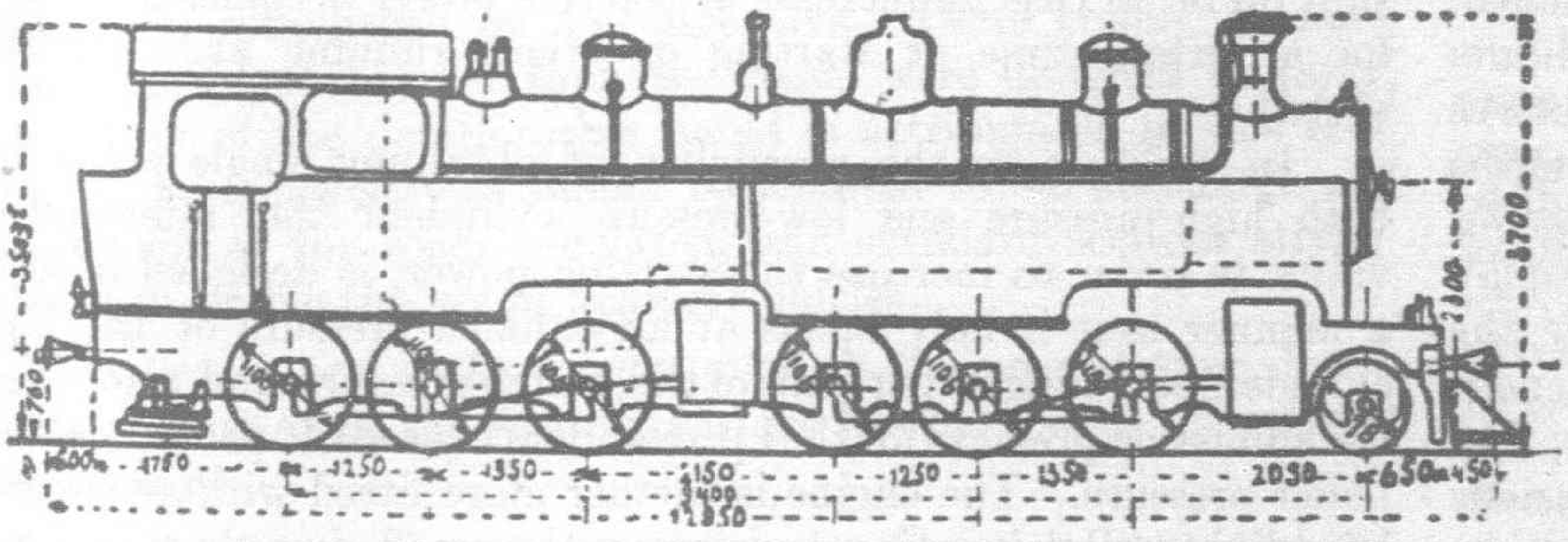
1 C Two-cylinder Compound Tender Engine

The application of the compound system was of great importance to the East Indies, and in the period from 1892 to 1902, a total number of 83 1 C two-cylinder compound locomotives were purchased from the Saxon Engine Factory, late Richard Hartmann, of Chemnitz.

B + B 1 Four-cylinder Compound Mallet Engines

It became necessary to construct a more powerful engine than the 1 C type for the mountain lines, resulting in ordering 16 B + B 1 Mallet four-cylinder compounds, of which 12 were supplied by the Saxon Engine Factory, late Richard Hartmann, of Chemnitz, and four by the Berlin Engine-Building Co., late L. Schwarzkopff: eight of these engines were put into service in 1900, four in 1907, and four in 1908.

These engines are serving on the Buitenzorg and Padalarang division where the traffic is moderate and the maximum gradients 40 per cent. and 25 per cent., and where the curves have a minimum radius of 150 m. On the 40 per cent. gradients, two engines are used, whilst the maximum train-weights for 25 per cent. gradients amount to 110 tons for fast trains and 130 tons for mixed and goods trains.

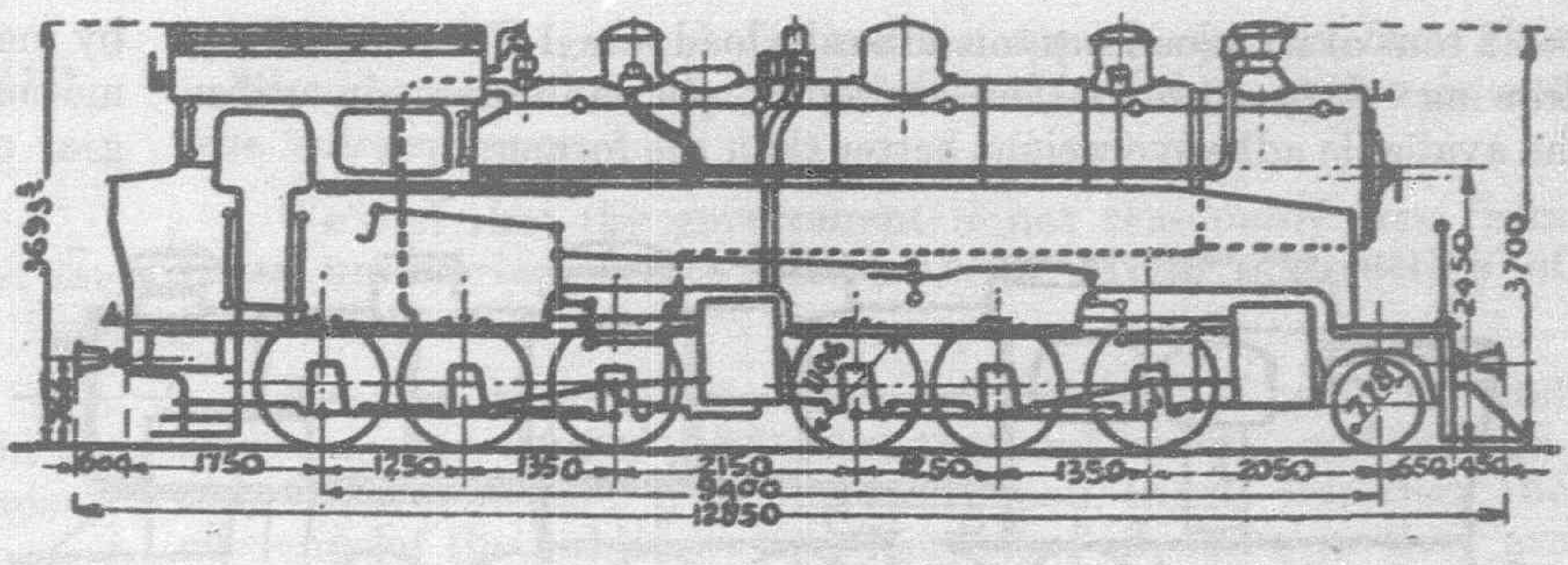


1 C + C Large Mallet Type Tender Locomotive No. 521-543

1 C + C Mallet Four-cylinder Compound Locomotive

Four years later even more powerful locomotives became necessary for the Poerwakarta-Padalarang and Tjitjalengka-Bandjar mountain lines, The 1 C + C type was chosen, and 34 engines put into service up to 1911. The Saxon Engine Factory (late Richard Hartmann of Chemnitz) supplied the first 13, with a repeat order of four, the Berlin Engine Building Co., Ltd. (late L. Schwarzkopff), of Berlin, supplied six, and the Netherlands Machine and Railway-material Factory of Amsterdam, the last batch of 11. They were to run at a speed of 40 km. an hour, and on curves of 150 m. radius. The presence of a leading radial axle and the much larger total wheelbase of the front truck have exercised a very favorable influence upon the wear and tear of the front driving-axle's flanges and also upon the very steady running at comparatively high speeds as compared with the B + B 1 type.

The engines are at present serving, amongst others, on divisions having gradients of 25 per cent. and curves with a minimum radius of 150 m. and are capable of hauling on those gradients, fast trains of 160 tons at a speed of about 31 km. an hour, and mixed and goods trains of about 180 tons at about 25 km. an hour; maximum speeds of 45 km. an hour are admissible without causing any difficulty.



1 C + C Large Mallet Type Locomotive No. 551-561

1 F 1 Twin-cylinder Super-heater Engine

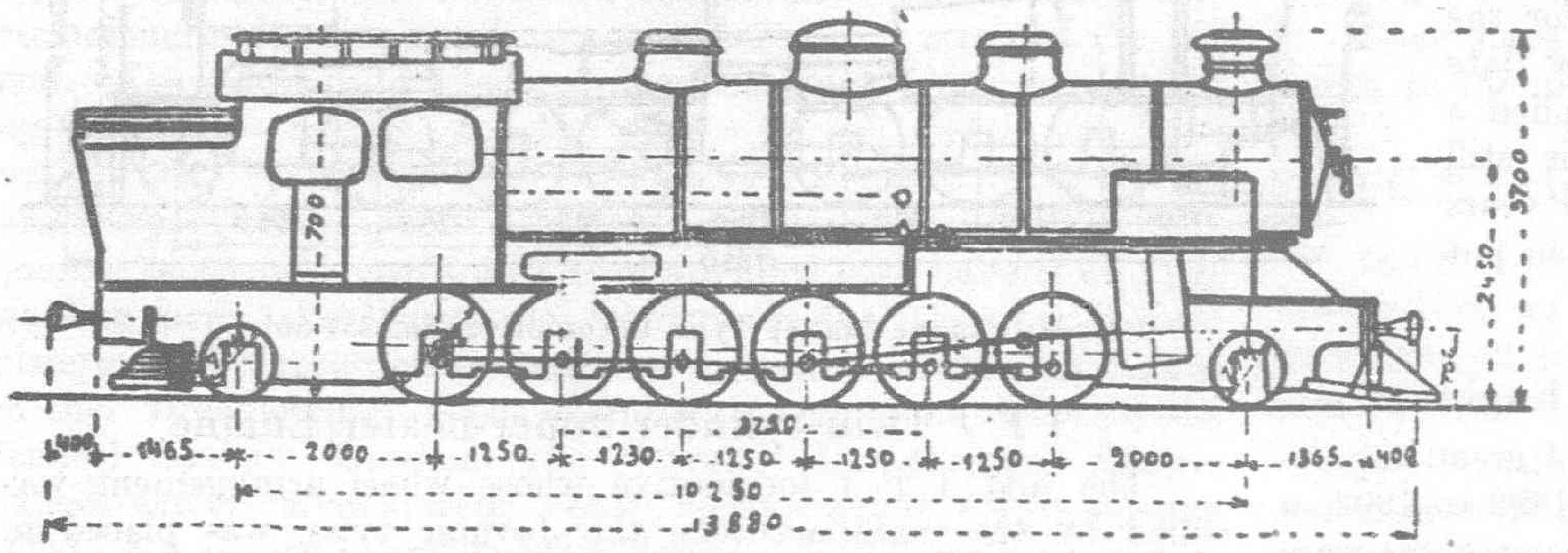
The first 1 F 1 locomotive whose wheel arrangement was called by the manufacturers, the Javanic type, was placed in operation on the western lines as early as 1912. Since that time 23 engines of this type have been supplied, 16 by the "Hanover Engine-Building Co., Ltd., late George Egestorf, of Hanover-Linden; and seven by the Netherlands Engine and Railway-material Factory of Amsterdam. They are designed for running at a maximum speed of 50 km. an hour on curves of 150 m. radius, with at least 20 mm. enlargement of the gauge. The boiler is fitted with a super-heater, Schmidt system with 18 flues of 124 to 133 mm. diameter, and with automatic superheater damper in the smoke-box; the superheater pipes have got welded heads "Thyssen" system. The frame-plates are 23 mm. thick and well stiffened transversely. The front and middle water-tanks with strengthened top-plates are situated between the rear water-tank and the coal-box at the back above the frame-plates. In this manner a water-supply of 8.5 $m.^3$ is obtained without impeding the outlook of the driver and stoker.

The front and rear trailing-axles are of Adams type, designed with a radius of 2,400 mm., with centering springs giving a maximum centering force of 1,200 kg. The lateral play in either direction amounts to 100 mm. The axle-boxes are of cast steel fitted with wrought steel sliding plates under the hardened, mild steel sliding shoes. These are constructed in such a manner that oblique positions will not cause any chafing or gripping between shoes and the sliding-plates, whilst a plentiful lubrication has been provided for.

The first and last one of the coupled axles are so-called Gölsdorf axles which have a lateral play of 30 mm. on either side in the bearings. In this way the fixed wheelbase is diminished to 3,750 mm. Easy running through curves of 150 m. radius is moreover guaranteed by turning the flanges of the two middle axles (the driving-axle and the next coupled-axle) 4 mm. thinner. The Gölsdorf axles are fitted with coupling-rods having vertical and horizontal hinge bolts, whilst the coupling-rod brasses are designed according to the "Hagans" system with universal joint. The springs are joined in pairs by equalizer's, that is, those of the leading trailer to the first coupled axle those of the 2nd coupled-axle, to the driving-axle; the fourth to the fifth coupled-axles also whilst the load on the 6th coupled-axle is equalized with that of the rear trailer. The regulating of the axle loads is done as if the engine were carried on four (double) axles. The trailing axles springs bear by means of supports on the top of the axles boxes.

The outside cylinders have piston-valves 200 mm. in diameter of the model of the Prussian state railways with narrow rings of 6 + 8 mm. "Robertson" system and single admittance driven by a "Walschaert" gear. The cylinders have bypass cocks which are manipulated by the driver by means of handles and levers the cylinder covers are fitted with self-adjusting stuffing-boxes of the Schmidt system, and with safety and relief valves. The engines are able to haul mixed and goods-trains of 230 tons on gradients of 25 per cent. In comparison with the 1 C-C Mallets which haul only 180 tons with an adhesive weight of 55.965 tons resulting in $\frac{180}{55.965}$

=3.2 tons of trainload per ton adhesive load, the 1 F 1 locomotives, drawing $\frac{230}{62.63}$=3.7 tons of trainload per adhesive ton utilize the available adhesive weight better than the former.



1 F 1 Tender Locomotive No. 801-823

1 D + D Mallet Four-cylinder Compound Superheater Engine with Separate Tender

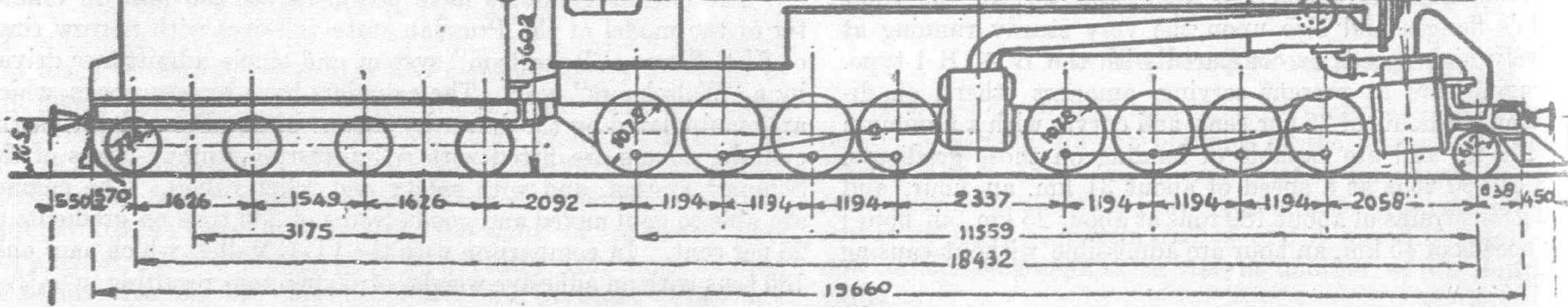
The development of the passenger and goods traffic on the mountain lines increased by such leaps and bounds, that it became necessary, in order to avoid regular double traction, to design a type of engine which should be still more powerful than the 1 C + C and the 1 F 1 type, especially as the 1 F 1 type caused difficulties in connection with the small radii of the Preanger lines, on account of the wear of the flanges. Since in addition the maximum axle-load for the existing lines was limited and for other reasons the choice could not fall otherwise than on the mallet type, because only with this type could the number of adhesive-axles be increased in a rational manner above the limit of six whilst retaining sufficient pliability in curves.

In ordering the 1 D + D type with an average load on the coupled axles of 10.5 tons for rail No. 2, the utmost which can be reached with a gauge of 1,067 mm., was very closely approached, taking into consideration the available gauge limits and the limits fixed by the weight-arrangement. The 1 D + D locomotives were ordered in 1916 and eight were supplied within six months by the American Locomotive Co. They are the first engines of American make which the state railway has employed, and display the typical peculiarities of the land of their origin. Unlike the other mountain-line engines, they have a separate 4 axled tender with a watercapacity of 20 m.³ and a coal capacity of 8 tons. The bar-frames of 89 by 89 mm., are stiffened transversely in various places with cast steel parts, whilst large, cast iron steam-chests form the inter-connection between the cylinders. There are wedges to the driving and coupled axle-boxes. The main-rods have adjustable brasses, the side rods, on the other hand, have pressed in bushes. The front trailer forms part of a bogie-system with cradle suspension and has got a radius of 1,295.5 mm. All the springs of the front and back frames are interconnected by means of equalizers.

The outside high-pressure cylinders of 445 mm. diameter have got piston-valves with rings 5-8-in. wide and 3-4-in. thick. The outside low-pressure cylinders have got sliding valves balanced by means of balance strips and a diameter of 711 mm. The valve motion gear is in accordance with the Walschaert system the gear of the two pairs of cylinders being interconnected in such a way, that increase (or decrease) of admission into the h.p. cylinders involves increase (or decrease) of admission into the l.p. cylinders. The boiler, fitted with a Schmidt super-heater for temperatures of about 350° C with 24 flues of 128 to 137 mm. diameter and automatic damper shutters in the smoke-box, is well supported in the middle part by the saddle between the h.p. cylinders, and a sliding support near the fire-box as well, whilst the front support is obtained by a strongly constructed bearing saddle against which the centering springs press.

The smoke-box is arranged in American style. Only the l.p. cylinders have got an automatic by pass valves with differing face areas. The steam-chest pressure works on the smaller surface, the outside air on the larger one, by which means when running under steam, the bypass is shut off, whilst when running with the throttle closed, on account of the vacuum in the l.p. steam-chest, the discvalves are moved by the outside air causing the steam-ports to be interconnected. Another peculiar feature is the intercepting valve situated in the h.p. cylinder casting. It has for its object, to admit live-steam of reduced pressure into the receiver-chamber at starting, to shut off this chamber from the h.p. exhaust, and to allow the direct exhaust of the h.p. cylinders into the outside air. For that purpose the apparatus consists principally of three valves, namely, (1) a reducing valve, (2) an intercepting valve, and (3) a auxiliary exhaust valve. At starting, the mechanism acts entirely automatically, with the exception of the auxiliary exhaust valve which, in special cases, is manipulated from the cab by the engine-driver (for instance in case there is anything wrong with one or more of the steam cylinders so that they have to be shut off or, in case an increase of tractive power becomes necessary for a certain time at starting or when running at very low speed).

In addition to the possibility of obtaining single action of both high-pressure and low-pressure cylinders the intercepting valve, in order to increase the starting power, is designed in such a manner that it only opens at an exhaust-pressure of the h.p. cylinders equalling 30 per cent. of the boiler-pressure and also when the admission pressure for the l.p. cylinders exceeds 40 per cent. of the boiler pressure. The engine is further more fitted with an electric head-light of Pyle's national system, with a small, directly connected turbo-generator. The eight engines are now serving on the division Poerwakarta-Padalarang and haul fast train weighing 300 tons on a gradient of 1-65 at an average speed of 38 km. an hour and also mixed and goods trains of 450 tons at an average speed of 29 km. an hour, developing an estimated power of about 1-300 i.h.p. They pass the curves very steadily and are in this respect beneficient for the line. In consequence of the pressing needs of tractive power on the Bandoeng-Bandjar division, another 20 engines of this type have been ordered, with a few improvements which were considered desirable (stronger frames, automatic stoking, etc.)



1 D + D American Mallet Locomotive No. 1201-1208

Report of the Wood-Forbes Mission

(Continued from page 797)

of funds. The completion of these projects is of the utmost importance and it is an encouraging sign of progress that they have advanced as far as they have.

There are now 2,920 miles of roads rated as first-class in the islands and 7,500 permanent bridges and culverts. The standard, however, of first-class roads has been lowered and we found many roads rated as first-class which are not so. There was an earnest effort made by the government to hurry through deferred repairs in order to prepare the roads for inspection.

During the earlier periods a system of road construction and maintenance was adopted and consistently followed. All structures on first-class roads were reinforced concrete and a standard system of road construction adopted suited to the traffic. Although the work progressed slowly, it was thoroughly well done, adequate provision being made for constant maintenance by a force of laborers. The result was that the road service reached a high degree of perfection, comparing favorably with the roads of any other country and much better than most roads in America. The terrific force of the torrential rainfall in these islands made these precautions necessary.

We have to record that this system has not been consistently maintained; the roads are falling into disrepair, some are impassable and the system of maintenance is carried on spasmodically. In certain districts money has been spent for new roads instead of keeping up the old ones, which is unwise. We also regret to say that a tendency has crept in to revert to the old practice of building bridges and other structures, of wood, and a uniform policy of permanent construction has not been maintained. This practice, in the long run, is poor economy. Heavy trucks have been purchased for carrying passengers and freight, and regular routes have been established on the highways. These trucks, in some cases, are much heavier than the roads were designed to carry, and much of the deterioration noted is attributable to this fact. The maintenance service should be restored to old standards and the weight of the roads regulated, and standard sections strengthened to enable the use of heavier vehicles.

The roads are, at first sight, good at the present time, but a great proportion of the wearing surface has been worn off without replacement.

In the mountain province and non-Christian provinces we find that the service of maintaining the roads and trails has been neglected, but it is believed that a better organization can remedy these defects without the necessity of additional revenues.

Government in Business

The government has entered into certain lines of business usually left to private initiative. Among these can be cited the National Bank with disastrous results, the purchase of the Manila Railroad Company now operated at a loss, also the National Development and National Coal Companies, etc. At the request of the mission a thorough examination of the Manila Railroad Company was made by competent army engineers whose report is among the exhibits. In our judgement the government should, as far as possible, get out of and keep out of such business.

General Conclusions

We find the people happy, peaceful, and in the main prosperous, and keenly appreciative of the benefits of American rule.

We find everywhere among the Christian Filipinos the desire for independence, generally under the protection of the United States. The non-Christians and Americans are for continuance of American control.

We find a general failure to appreciate the fact that independence under the protection of another nation is not true independence.

We find that the government is not reasonably free from those underlying causes which result in the destruction of government.

We find that a reasonable proportion of officials and employees are men of good character and ability, and reasonably faithful to the trust imposed upon them; but that the efficiency of the public services has fallen off, and that they are now relatively inefficient, due to lack of inspection and to the too rapid transfer of control to officials who have not had the necessary time for proper training.

We find that many Filipinos have shown marked capacity for government service and that the young generation is full of promise; that the civil service laws have in the main been honestly administered, but there is a marked deterioration due to the injection of politics.

We find that there is a disquieting lack of confidence in the administration of justice, to an extent which constitutes a menace to the stability of the government.

We find that the people are not organized economically or from the standpoint of national defence to maintain an independent government.

We find that the legislative chambers are conducted with dignity and decorum and are composed of representative men.

We feel that the lack of success in certain departments should not be considered as proof of essential incapacity on the part of Filipinos, but rather as indicating lack of experience and opportunity, and especially lack of inspection.

We find that questions in regard to confirmation of appointments might at any time arise which would make a deadlock between the governor-general and the Philippine senate.

We feel that with all their many excellent qualities, the experience of the past eight years, during which they have had practical autonomy, has not been such as to justify the people of the United States relinquishing supervision of the government of the Philippine Islands, withdrawing their army and navy, and leaving the islands a prey to any powerful nation coveting their rich soil and potential commercial advantages. In conclusion, we are convinced that it would be a betrayal of the Philippine people, a misfortune to the American people, a distinct step backward in the path of progress, and a discreditable neglect of our national duty, were we to withdraw from the islands and terminate our relationship there without giving the Filipinos the best chance possible to have an orderly and permanently stable government.

Recommendations

1. We recommend that the present general status of the Philippine Islands continue until the people have had time to absorb and thoroughly master the powers already in their hands.

3. We recommend that the responsible representative of the United States, the governor-general, have authority commensurate with the responsibilities of his position. In case of failure to secure the necessary corrective action by the Philippine legislature, we recommend that congress declare null and void legislation which has been enacted diminishing, limiting, or dividing the authority granted the governor-general under act of congress No. 240 known as the Jones bill.

3. We recommend that in case of a deadlock between the governor-general and the Philippine senate in the confirmation of appointments that the president of the United States be authorized to make and render the final decision.

4. We recommend that under no circumstances should the American government permit to be established in the Philippine Islands a situation which would leave the United States in a position of responsibility without authority.

The Far Eastern Review

SHANGHAI, DECEMBER, 1921.

Zones of Strategy

IT is difficult at this time to forecast all that the Pacific conference will bring forth. We are informed that Japan will accept the American proposal for the limitation of naval armaments, and the Anglo-Japanese alliance will give place to a new quadruple entente in which America, Britain, France and Japan will guarantee the peace of the Pacific. This much seems assured.

The most important fact disclosed by the conference leaders is embraced in the explanation given by Mr. Balfour of Britain's reasons for demanding the Kowloon lease in 1898. "*Without the leased territory Hongkong would be perfectly indefensible; at the mercy of any enemy with modern artillery.*" Which means, that any enemy could violate the neutrality of China with impunity and from the Kowloon hills bombard Hongkong and force its capitulation. To our recollection, this is the first time that a British statesman has so openly defined the vital necessity which compelled his government in 1898 to forcibly extend its authority over Chinese territory. It will interest Americans to know that altogether apart from the basic strategic reasons arising out of Britain's fear at that time of Russia and France, American infringement of China's neutrality provided the immediate provocation for Britain's agression in Kowloon. When war with Spain was declared on April 20, Dewey's squadron laid at anchor in Hongkong harbor, feverishly coaling for a long cruise. It was not until April 25 that the squadron left Hongkong for Mirs Bay, about fifty miles distant in Chinese territory, remaining there until mid-day of the 27th before starting on its eventful voyage to Manila. Technically, there was no violation of China's neutrality, as the squadron did not exceed its twenty-four-hour privilege, but the incident brought forcibly home to the British military authorities the vulnerability of Hongkong in the event an enemy might land in Chinese territory and lay seige to the rock from the Kowloon side.

The real justification, however, arose from the fact that Li Hung-chang and Chang Ing-huan had accepted Count Witte's bribes of 500,000 and 250,000 roubles respectively and sold China into an alliance which presented Russia with an ice free port on the Pacific and facilitated her designs on India and Britain's position in Eastern Asia. This was the beginning of China's troubles, the key to every move made on the Far Eastern chessboard right down to the imposition by Japan of the twenty-one demands. Mr. Balfour emphasized officially the previous utterance made by Sir John Jordan before the China Society, to the effect that "nearly all the trouble that has arisen in China since 1895 was due to Li Hung-chang's diplomacy." If the world would seek to understand all that these quiet diplomatic statements imply, and would analyze the incidents one by one that followed the signing of the Li-Lobanoff treaty of alliance and the entrance of Russia into Port Arthur and South Manchuria, a flood of light will be thrown on moves which have been interpreted as wilful aggressions upon China's sovereignty. If we will keep these facts always before us, the so-called "spheres of interest" in China alleged to have been designed for commercial exploitation, will shape themselves into zones of strategy, created by various powers to protect their territories against the ever onward march of Russia.

The sledge hammer blows which cracked the hoary old empire into so-called spheres of interest in 1898, were the logical aftermath to Li Hung-chang's *laison* with Russia, and precipitated by China's breach-of-faith with England in the Peking-Hankow railway deal which enabled Russia to evade her understanding with Great Britain and carry her that much nearer her coveted goal on the northeast frontiers of India. The British ultimatum to China demanding compensation for this breach-of-faith is the key to British policy, giving the direct lie to all that has been written about the establishment of spheres of commercial influence, and closing the door to the trade of other nations in the Yangtze valley. This ultimatum is the most concise and emphatic document on record in diplomatic intercourse. "*You are authorized to inform the Tsung-li yamên that unless they agree at once (to the demands for compensation) we shall regard their breach of faith concerning the Peking-Hankow Railway as an act of deliberate hostility against this country, and shall act accordingly. After consultation with the admiral you may give them the number of days or hours you may think proper within which to send their reply.*" There can be no misinterpretation of this message from Downing Street to the British minister at Peking. It says in plain words that China had committed a hostile act against Great Britain, and this can only be interpreted that the British government was fully informed as to the working of the Li-Lobanoff alliance and Russia's object in furthering her advance upon India through the territories of her dupe. The note breathes the grim spirit of the Anglo-Saxon to resort to instant hostilities when their vital interests are placed in jeopardy. There was no trade policy here, no special desire for railway privileges to create markets for British materials, no intention to create a sphere of interest in order to keep other nations out; simply the common, ordinary prudence of a determined people to protect themselves at all hazards against a sly, and unscrupulous enemy. When these basic facts are driven home to the drivelling sentimentalist, who persists in approaching this problem from the angle of commercialism, the world will begin to understand something of the basic problem of China, an understanding that has been made possible by the clear cut explanation of Mr. Balfour concerning Britain's position in Hongkong and Kowloon.

Every move that has been made since that date (with special reference to railway concessions) was based on strategic reasons, the constant checkmating of Russia working through Belgium or France to cut China in half with strategic railways for the ultimate conquest of India and subjection of Japan. The closing of one section of China after another which followed had no commercial significance. It is only necessary to recall that the last official British utterance on this subject came when Sir Edward Grey made his declaration before the house of commons in July, 1914, that all railways in the Yangtze should be British railways, and the French government a month after the outbreak of the world war, with the Germans at the gates of Paris and the archives of the republic on the way to Bordeaux, forced China to close the province of Kwangsi to all railway construction other than French. Three months later Japan presented her twenty-one demands. At that time China was cut in half north and south and east and west by the Russo-Franco-Belgo combination of railways, a situation that carried an unmistakable menace to Japan and Great Britain. The same principle obtained in the Taonan-Jehol railway, where Japan was forced to demand concessions from China in order to protect herself against the moves of Russia to flank her position through the annexation of Mongolia. The problem of China, reduced to its lowest terms, has been strategical, created by her own weakness and the venality of officials who have refused to see that these moves constituted a menace to the peace of her neighbors.

The sins of their fathers are being visited upon the Chinese of to-day. Young China, the product of American and other Western universities, are paying for the errors and cupidity of a past (and present) generation. They clamor loudly for "justice" but fail to understand that this boon is reciprocal, to obtain which, they must guarantee to other powers that their vital interests will not be jeopardized through China's weakness and disorganization. The highest duty of real friends of the Chinese is to place this truth before them. China's regeneration and restoration to a place amongst the nations must come from within. A strong and united government shouldering its share of the load for the maintenance of Asiatic peace must be established before China can hope to realize its dreams. And, it may be said, that these aspirations will not be advanced when the son of the ruler of Manchuria is caught red-handed evading the law by selling large quantities of arms to the Russians. Li Hung-chang's venality brought China to her present hopeless position. The cupidity of men like young Chang may make it impossible for her friends to protect China from the consequences of these follies. G. B. R.

The Shaw Case

AT the recent convention of the associated British chambers of commerce held in Shanghai, Mr. A. W. Burkill, the chairman, reaffirmed the position of the British commercial community on the Shaw case. After describing the conditions under which Mr. G. L. Shaw carried on his business at Antung, the reasons for his arrest and incarceration by the Japanese authorities in Korea, he touched upon the conflict between British (and American) and the continental system of jurisprudence as adopted by Japan. As Mr. Burkill points out, "the right of one state to try the subject of another state for an offense committed outside its own borders and jurisdiction, involves a legal point of considerable interest. The practice of various countries differs on this point. Some continental countries, including France and Germany, hold that they have the right to try such offenders if once they place themselves within their jurisdiction. Great Britain and America claim no such right, which indeed, adds Mr. Burkill, appears to be repugnant to Anglo-Saxon tradition."

This, in reality, constitutes the issue in Shaw Case. With this exposition of the facts surrounding the clash of jurisdiction, it is clear that as long as these laws are written into the Japanese statute books, their officials have no option other than to carry them into execution, whenever a foreigner, who, in their opinion, has violated these laws, places himself within Japanese jurisdiction. No matter what views other nations may hold as to their jurisdiction in such cases, Britons and Americans cannot be expected to sympathize with such a system, for, under existing conditions of travel and international intercourse, with the main lines of communication across the Pacific passing through Japan or Japanese territory, foreigners are exposed to the application of Japanese law, for infractions committed in their own or other countries.

The case is still *sub-judice*, with Mr. Shaw out on bail awaiting further action on the part of the Japanese authorities. It can be readily understood that the British government will be reluctant to consent to the appearance of Mr. Shaw before a Japanese court and so create a precedent that might have far-reaching consequences. On the other hand, the Japanese government apparently has no desire to press the case and precipitate a crisis in their relations with Great Britain, so a deadlock has been created, which neither side can break without loss of national dignity.

It is to be regretted that Japan's action has been construed as a disguised economical weapon to undermine or drive out British trade in the port of Antung built up largely through the efforts of Mr. Shaw. Mr. Burkill admits frankly that the British attitude on the Shaw incident lays them open to the charge of being anti-Japanese, and he hastens to add :

> "We are not anti-Japanese in the sense that we are opposed to Japan's legitimate aspirations. We realize the vital character from her point of view of many of her aims, and we are perfectly willing that she should succeed and prosper in such aims. Both from a political and an economic standpoint we see how much is to be gained from co-operation and compromise and how much there is to lose from mutual jealousies and antagonisms. In a word, we want as far as possible to work with Japan and not against her. Whilst we wish this, indeed because we wish it, we are bound when we think that Japan is acting in a manner inimical to our interests to tell her so. We should be false both to her and to ourselves if we did not. And on the Tsingtao question, in regard to Mr. Shaw, and in the matter of obstructive regulations we think that our criticisms have been justified."

Mr. Burkill took the manly and commenable course in pointing out the reasons for British criticism against Japanese methods. Real friendship for Japan demands such open and frank criticism so the higher Japanese authorities will know what they have to contend with and make the necessary corrections, if corrections are justified.

The recommendation of the British chamber of commerce that Mr. Shaw be brought before a court of competent jurisdiction, and if no charge can be lodged against him, ample compensation be given for the treatment accorded him, seems equitable, and no doubt under ordinary circumstances would commend itself to the Japanese government. This means, however, that Japan must prefer charges and submit evidence against Mr. Shaw in a British court, and expose the working of her secret service in Korea. We are not familiar enough with British law to express an opinion on this, but are certain that such a case could never be brought before an American court. In a country which political refugees, revolutionists and filibusters have used as their headquarters to carry on warfare against other governments, it would be impossible to indict for an allegation of being in sympathy with or aiding and abetting a revolution against the rule of Japan in Korea. We assume the same law principle prevails in Great Britain. If so, it would seem to weaken the recommendation of the British chamber of commerce. If Mr. Shaw is to receive compensation for his sufferings while under arrest in Korea, it would appear that this can come only from a spontaneous recognition on the part of Japan that a mistake has been made. If the British government is adverse to creating a precedent recognizing the jurisdiction of Japan in similar cases, and the Japanese government is reluctant to press a point from which no tangible benefits can be derived, it would seem that a little heart-to-heart talk between trained diplomats, such as cleared the atmosphere for British interests at Tsingtao, might bring results highly gratifying to both sides.

* * *

The Future of Japanese Engineering

IN the event that the proposals of Secretary Hughes materialize into an international agreement for the reduction of naval armaments, the greatest sufferers financially will probably be the Japanese shipbuilders, who, after staggering through the depression of the past two years, will have to face this final knockout blow and go to the wall unless assisted in some manner by their government. The largest of these yards, the Mitsubishi, Kawasaki, Uraga, Fujinagata, Ishikawajima, Yokohama and the Osaka Iron Works will be vitally affected. All of these companies have expanded their capital since the termination of the war, in some instances by absorbing smaller yards who were the first to feel the effects of the depression. They have also extended their plant and looked forward to the distribution of government orders for naval construction. Especially is this so in the case of the two largest yards, the Mitsubishi and Kawasaki, who have repeatedly expanded their plant to take care of the ever-increasing demands for war equipment in addition to their regular commercial business. There is no relief in sight for these larger yards from new commercial shipbuilding, due to the great excess ocean tonnage now lying idle in all ports of the world.

The Yokohama and the Uraga Dockyard Company will be hard hit by the total suspension of warship construction. Since Mr. Hughes' proposal became known, Japanese shipbuilders are greatly concerned about the future of their business and are considering a petition to the authorities for relief. The companies usually have paid money as penalty to the government when they have failed in the delivery of warships at fixed dates. But they will be unable to receive indemnity from the government when the latter discontinues the contracts for warship construction as the result of the enforcement of the navy reduction agreement. Therefore, they intend to petition the government for the payment of money for the discontinuation of its outstanding contracts with them. On the other hand, the government will suffer a huge loss from the waste of various large equipments, including a dock for the building and accommodation of a 40,000-ton ship at the Yokosuka Naval Dockyard.

The warships excepting submarines that have been contracted for with principal private shipbuilders number 30. When divided into various dockyards, they are the battleship *Tosa*, battle-cruiser *Atago*, light cruiser *Natori* and first-class destroyers *Kiyokaze* and *Karukaze* at the Mitsubishi Dockyard ; battleship *Kaga*, battle-cruiser *Takao*, light cruiser *Abukuma*, and second-class destroyers *Karukaya*, *Yuri* and *Omodaka* at the Kawasaki Dockyard ; light cruiser *Isuzu* and *Kinu*, second-class destroyers *Hishi*, *Hachisu*, *Ayame* and *Botan* at the Uraga Dockyard Company; second-class destroyers *Sumire*, *Moyogi*, *Kakitsubata*, *Tsutsuji Kaido* and *Basho* at the Ishikawajima Shipbuilding Yard; second-class destroyers *Tade*, *Ajisai*, *Shion* and *Nadeshiko* at the Ujinagata Shipbuilding Yard; airplane depôt ship *Hosho* at the Asano Dockyard Company; and gunboat *Nakoso* and special service ship at the Yokohama Dockyard Company.

The effect of depriving these establishments of naval work, must be felt in other directions. Most of these yards already specialize in turning out various kinds of boilers, engines and machinery of all kinds for the domestic market. It is folly to expect that these plants will be scrapped. Deprived of orders for war material, the plants will be converted into factories for producing machinery of all kinds, and with the start they have, in addition to geographical propinquity to the nearby markets of China and Eastern Asia, in time, will become most formidable competitors for the machinery trade. There are many excellent Japanese engineering installations in Japan and China, and it will not take long under the stimulus of competition for Japanese machinery to reach a high stage of efficiency. There are many European manufacturers now co-operating with Japanese for the erection of machinery manufacturing plants, and under such skilled supervision and direction the product will find its way into markets now monopolized by American and European manufacturers. The commercial war for the development of Asia will be intensified, with Japan in the most favorable position. It will come to that. Co-operation with Japan will not be spurned by America's competitors.

* * *

Exports the Salvation of Japan

Governor Inouye's Sound Views

IN the welter of propaganda and flood of articles about Japan and the Pacific problem now filling the pages of American newspapers, comes a concise, sensible statement from the one man most competent to speak on Japan's necessities. Mr. J. Inouye, governor of the Bank of Japan, stands as the foremost authority on national finances and trade, and when he consents to be interviewed, his opinions reflect the views of big business in Japan. Unquestionably, he stands to-day as one of the world's great financial leaders, under whose wise and skilful direction Japan has been carried safely through the period of depression and started along the road towards real prosperity. He recently gave out the following statement to the *Associated Press* :—

"The population of Japan is increasing by 600/700,000 a year, while the production of foodstuffs cannot keep pace with this steadily rising demand. We have at present about 4,000,000 spindles in cotton mills, but not a picul of raw cotton is now obtained in Japan. Our looms are capable of weaving yearly 34,000,000 yards of woolen goods for which no wool is supplied in our land. Again, steel is consumed in Japan to the amount of about 1,500,000 tons a year while the home production of iron ore aggregates not more than 130,000 tons.

"In these circumstances Japan cannot solve this vital question of economic existence without recourse to economic activity abroad. The necessity for activity by the Japanese in settling this question of existence will naturally be admitted by all other nations.

"As has been proved by history the Japanese people are really unfitted for emigration abroad so that it is almost vain to attempt to send the increase of population to other countries. There is, therefore, no way to secure the existence and the maintenance of this nation except through economic activity abroad.

"It is quite natural in this connection that Japan should prefer China proper, Manchuria and Mongolia with which she had had the most intimate relations historically and is also in close touch geographically. Because of this economic activity, however, Japan should not be misunderstood as insisting on exclusive territory, or seeking any kind of territorial acquisition, indeed there is not the faintest shadow of doubt that Japan does not intend to exclude the trade and enterprise of other countries in the matter of trade and commercial competition.

"Japan has sometimes been described as a nation of militarists or as cherishing ambition for territorial acquisition. In seeking the causes of such misunderstandings we must admit that Japan has often fallen into error in the past; she has made no small number of mistakes in her policies in China, in Manchuria and in Mongolia and in doing so has incurred much unfavorable criticism. But now the people of Japan have awakened to the situation and I do not think that Japan will repeat such mistakes in future.

"As stated before, Japan's economic activity must tend not only towards securing an outlet for the production of home industries, but further towards settling the vital question of her future economic existence. Consequently, there may be a difference between the economic activity of Japan and that of other nations in China, but the situation will readily be understood by all the powers.

"It is quite unreasonable to say that Japan intends to exclude other nations from these territories simply because she is driven by necessity to a greater tradal effort therein."

* * *

China's Great Opportunity

Perfect Substitute for Linens Found in China Grass

CALLING it the most perfect substitute ever found for linen, Felix Brecher, who returned to New York recently from a four-month trip abroad, during which he closed negotiations with William Rexroth, said to our correspondent that the newly perfected "solidonia," the proprietary name for the fibre obtained from China grass, is fully equal to linen, not only in appearance, but in absorbing property, strength and durability. He brought with him a wide range of yarns, threads and fabrics, together with collars and shirts made of this fibre.

The entire output of the Furstenberg, Germany, factory of Rexroth, is absorbed at the present by the German linen mills, Mr. Brecher said, but as soon as arrangements are completed on this side the material will also be manufactured in the United States for the domestic mills. No attempt, however, would be made to grow China grass for this purpose in California or any other part of the United States, because it was found that stalk grown by expensive white labor is about twice as expensive as that grown in China, from which country not only the Furstenberg factory is importing all its straw, but eventually the American plants also will obtain their raw material.

He estimated the present capacity of the Furstenberg factory at about 10,000 pounds of decorticated fibre a day, 4,000 pounds of roving and about 2,000 pounds of yarn, the output of the latter being dependent on the fineness of the count. With the machinery built specially for the purpose, yarn up to 100 leas can be spun, he said, and tests showed that the finest fabrics, such as sheers, handkerchief fabrics, dress goods, light cambrics, etc., can be woven of it.

Mentioning a few articles made lately in Germany from "solidonia," Mr. Brecher said that hand towels and dish towels, as well as sewing thread for shoes, were especially manufactured in large quantities. Some of the processes employ noil and waste spin yarn on the woolen or carded system especially for towels. The Furstenberg mill furnishes, in addition to yarns, solidonia roving to such mills as prefer to do their own spinning.

"I am of the opinion that for years to come there will be a scarcity of linen in the world on account of the Russian flax being missed from the markets, and for this reason China grass, which can be had in unlimited quantities, can be considered as the happiest solution of this problem, provided it is developed and treated in the proper manner," said Mr. Brecher.

In commenting on the manufacture of solidonia, he remarked that the problem with China grass was not only to separate the woody matter from the stalk, but especially to take out the resinous matter from the fibres without impairing the strength of the latter. The secret chemical and mechanical processes patented by Herr Rexroth are claimed to be only ones to accomplish this, he said. The machinery specially designed for the mechanical processes are being manufactured by the Saxony Machine Works, in Chemnitz and Dresden.

In conclusion, Mr. Brecher stated that arrangements have been made to bring Herr Rexroth to the United States soon, not only in connection with the contemplated factories for the manufacture of China grass, but also to study American fibres not yet utilized.

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Engineers All

A New International Contract

THE engineers of America, Great Britain and France having fought side by side during the war on the various fronts, are now drawing together in close harmony for the promotion of concord and international peace. In our last number we reproduced the message of the four great American engineering societies to their brothers in Great Britain; below, our readers will find an editorial from the *Mining and Scientcifi Press* which takes up and carries the idea to the point where a new international contact may be established. Modern civilization and industrial progress is largely the work of the engineer. Politicians, statesmen, soldiers, and other leaders, must, in the end, come to the engineer for advice and assistance. He is indispensible to progress; the development of China in the last analysis, rests upon his shoulders. International concord, peace and good-will, are mere words in this part of the world, unless the engineers of America, Britain, France and Japan co-operating with the Chinese, find some common meeting ground and use their combined intelligence and prestige for the development of China along lines that eliminate friction. No matter how unselfishly engineers at home work for a common understanding, their efforts will fail unless upheld by their confrerés on the firing line of the struggle for commercial supremacy. No good can come of the movement now gaining headway in the homelands, when engineers who fought side by side in France are transformed into bitter commercial antagonists in the peaceful war for markets. The present tendency of foreign engineers in China to form national associations instead of co-operating as a unit for the advancement of their profession is altogether out of harmony with the spirit of the times. Here is a situation that should be carefully studied by the members of the engineering society of China and the association of Chinese and American engineers, so that some way may be found to amalgamate these two important bodies, so that all can work together for the solution of China's problems and give effect to the principles so eloquently set forth in the following editorial:—

On October 10 a representative gathering of American engineers gathered at the Engineers' Club of New York to welcome delegates from the principal engineering societies of Great Britain and France. This event celebrated the return of the mission of American engineers that went abroad this summer to bestow the John Fritz medal upon Sir Robert Hadfield of London and M. Eugene Schneider of Paris; it also marked the launching of a movement to promote world-wide unity among the English-speaking peoples and among those who co-operated during the war against Germany. The idea of the movement was born during the war, when British and American engineers shared the perils of the battlefield and worked side by side with the French, particularly at the time when the German armies sought to drive the British under General Haig to the coast and win their way to the channel ports. It is proposed now to establish a new international contact between engineers on the two sides of the Atlantic, with a view to promoting concord between English-speaking countries, to advance the art of engineering, and to work along conservative lines for the establishment of international peace. The gathering on October 10 is expected also to mark the recognition of the engineer as a factor in constructive national and international policies as well as in the technical field to which he is particularly devoted. It is proposed to establish "a new international contact which shall promote concord among the English-speaking countries, advance the science of engineering, and work along conservative lines for the establishment of international peace." Never was a more worthy purpose announced; gentlemen, go to it, the profession that you represent so worthily is with you, heart and soul. Such a purpose should find support not only among Americans of colonial stock but among all intelligent and serious-minded citizens. We can imagine that it will make its appeal to German-Americans and others whom it is necessary to describe by means of a hyphen, for the movement is not political nor racial; it is the "peoples" that speak English that are asked to co-operate in furthering goodwill, not for political or economic aggrandizement, but to further the ultimate end of civilization, which is to promote the art of living in peace and plenty. Engineers—especially those devoted to mining—are nomadic persons, they make the whole world their field of action, and as travelers, more particularly in the countries where their own language is spoken, they should serve as excellent missionaries in behalf of a greatly useful idea. In a letter to Sir Robert Hadfield, Mr. Calvin W. Rice said: "We, as professional men, must not only have before us the highest ideals of the engineering profession but we must become internationally minded to the end that the peoples of all nations may be joined in the ennobling concept of a common ideal for all professional men throughout the world. It is not necessary to wait for leagues of nations to be consummated, and international tribunals to be effected, before practising what we preach in regard to peace." Nor need we wait for the disarmament conference in order to disarm ourselves of sundry provincial prejudices that stand in the way of such co-operation. Already we have set an example in our relations with our good neighbors, the Canadians. If two energetic and competitive peoples such as the American and Canadian can live side by side in amity and goodwill, then surely it may be hoped that other nations—all nations—will do the same eventually.

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Labor Unrest in China

By T. A. Chen, M.A.

Immediate Causes of Labor Unrest

(U.S. Department of Labor Report)

THE high cost of living is working havoc among the teeming millions of China. In the north, approximately five provinces, are suffering a great shortage of food. In central and south China, rice has become a very expensive commodity, costing between $12 and $17 a picul. Before the war, eggs in Ichang, Hupeh, cost 4.5 cents a dozen; to-day they cost at least 10 cents, an increase of more than 100 per cent. The dwelling houses in Shanghai, with two rooms on the ground floor and two more on the floor above, now rent at from $240 to $360 per year, and there has been an increase in rent of about 150 per cent. in two years. The woman workers of the American-British Tobacco Co., of Pootung, recently went on strike on the very issue of the high cost of living, alleging that the introduction of a new system of packing cigarettes would adversely affect their wages, thereby necessitating a lower plane of living. Again, though prior to the Shanghai carpenters' strike of June 12-16, 1920, the employers had given an explicit promise to raise wages within 12 months, the workers declared that the steady mounting of retail prices would not permit them to wait, and immediately resorted to direct action.

The precariousness of the situation is aggravated by bolshevist propaganda. Sporadically, radical doctrine had crept into university lectures; but its penetration into Chinese industries was not definitely manifested until the ninth anniversary of the Chinese republic, October 10, 1920, when the bolshevik agents in Shanghai issued circulars informing their Chinese comrades: (1) That the Peking government, being in the hands of the capitalists, was oppressive to the masses; (2) that in bolshevism the workers would find the only object worth living for; and (3) that the people of Russia had already achieved this object after three years' vigorous struggle. Quietly and steadily this force has been gaining a foothold in the rank and file of labor. In February 1921 the Chinese chargé d'affaires in Denmark, who was then well informed on the Russian situation, advised Peking of the broadcast propaganda of the Moscow society in Tientsin, Shanghai, Hankow and Canton. A few weeks later Peking residents were startled by motor cars flying a red flag with a star and the letters F.E.R. (Far Eastern Republic). Thereafter the Chinese government felt it necessary to take precautions against lectures on communism and *pseudo*-welfare speeches delivered at mining camps and industrial centres ostensibly for the benefit of the workers.

Furthermore, the mushroom growth of home industries has called for an increased supply of labor. Within the last two years there have sprung up in the Yangtze valley 53 factories, 26 electric plants, 18 transportation companies, 16 cotton mills, 16 agricultural enterprises, 15 commercial houses, 12 mining companies, 3 fisheries and 8 miscellaneous companies—aggregating a total investment of $74,187,470.

Underlying Causes of Labor Unrest

About one-fourth of the Chinese population must earn its living by skill or by mere physical strength. For many years this class has been subject to economic exploitation by the landowners, capitalists and middlemen.

High rates of interest and high rents in rural communities work hardship on the agricultural laborer. The landowner usually exacts from 13 to 20 per cent. interest on his loans and charges about the same rate of interest on mortgages. In hiring a helper, the farmer has to take this excessive rate of interest into account, especially if he himself is in debt, and so he feels it necessary to keep the wages down. A farm helper rarely gets more than 25 cents a day, plus board and lodging. Besides regular work on the farm, he attends to such odd jobs as drawing water from the well or getting fuel for the kitchen. Rent also is high. The tenant pays the owner from 1.4 to 1.8 *tan* per *mow*, out of an annual yield of from 3.2 to 3.8 *tan* per *mow*, or about 46 per cent. of the gross produce. The amount the mortgagor-farmer pays in interest to the mortgagee and wages to the helper (if any) amounts to the same as the tenant pays to the landowner. The laborer lives from hand to mouth. The small farmer can save little. The wealth seems to concentrate in the hands of the landowners. There would appear to be no promise of economic prosperity for the small farmer or the worker, unless the rate of interest is made materially lower by the introduction of some such plan as the rural credit system in the United States.

The city worker, in some cases, is in no better position. Take the rickshaw coolies of Shanghai, for example. They number about 35,000 in all, and their work is divided into day and night shifts. For the privilege of rickshaw pulling, a license is required, covering one of the three routes; for the whole city the license costs $5; for the French-Chinese section, $3; and for the Chinese section, $1. This fee is paid by the owners, who have organized themselves into the rickshaw association. The agents of the association then rent the rickshaws to the coolies at various rates. For the whole city, each rickshaw is rented at 85 cents a day, of which 70 cents goes to the owner, and the remaining 15 cents to the agent; for the French-Chinese section, it is rented at 52 cents, of which 40 cents goes to the owner and 12 cents to the agent; for the Chinese section, it is rented at 36 cents, of which 30 cents goes to the owner and 6 cents to the agent. The coolie then assumes all the risk of making a sufficient daily wage to keep himself, after paying this high rate of rent. As a result, the daily wage varies from 45 to 85 cents, or about the same as the owner of the vehicle gets. Occasionally, he may get two or three dollars a day. But rickshaw pulling requires much physical exertion, and an average person cannot stay in the trade in vigorous health for more than ten years.

The case of the Shanghai maidservants illustrates another underlying cause of unrest—the usurious share of wages demanded by the middleman. As these women come from Soochow, Yangchow and Anching and have no homes in the city, their employment is usually obtained through a private agency, similar to an employment bureau. The agent makes arrangements with the employer and then recommends the maid. If the three-day trial proves satisfactory, the agent closes a contract with the employer and demands an exorbitant charge for his services. As long as the servant works the agent deducts 20 cents from every dollar she gets, and obtains another 20 cents from the employer for every dollar he pays to the maid. The middleman thus robs both the employer and employee, but the latter suffers most bitterly.

While these cases are not universal, they clearly indicate labor's inability to get an equitable reward for its share in production

The workers are further burdened by large families. The 1910 estimate of the *Ming-chen-poo* (ministry of the interior) conservatively puts the average number of children per family in China proper at 5.5 and in Manchuria at 8.3. Taking the daily wage of an average factory worker at 45 cents and striking off 5 per cent. for such luxuries as tobacco and tea, he has 42.5 cents left on which to feed himself and his family. Even though his wife does some sewing and his children do some light work at the factory, it is impossible for the family to live decently.

Manifestations of Unrest.—Strikes

In industries where the workers are well organized, their discontent as to conditions of employment is expressed through the strike. On March 3, 1921, the whole force of the French tramways in Shanghai went on strike, having made eight demands. The strike lasted four days, and on the fifth day the workers resumed their work, with the definite understanding that the wages would be raised 20 per cent. as demanded.

Another important strike was that of the Shanghai carpenters, June 12 to 16, 1920.

The contagious strike spirit, now so generally prevalent in China, was quickly caught by the prison laborer, and the first "hunger strike" occurred in Shanghai not long ago.

On March 14, 1921, 1,500 teachers in eight government schools in Peking went on strike, leaving 40,000 students without instruction. They demanded that back salaries to the amount of over $400,000 be paid immediately, that salaries be increased, and that a change of government policy regarding appropriations for public education be made.

Agitation

In industries where the strike has not been used, trouble has been brewing unseen. For a long time there has been agitation for increase in wages.

Within labor organizations agitation for better working conditions is, in a large measure, dependent upon the boss or head man. The personality of the head man is usually of a forceful type and he possesses a high degree of shrewdness and unusual power of persuasion. Since many workers are illiterate, they rely upon him for information about wages, hours of work, and conditions of employment. The unquestioned confidence of the workers in the head man assures him always of a loyal following in whatever course he may take. Thus, the Hongkong strike of April 1920, which involved 9,000 workers and was a gigantic protest against indequate pay, was started by a handful of labor "leaders" who may be accurately described, in western terminology, as "professional agitators."

Part of the labor agitation in China is carried on voluntarily by the liberal press and the National Students' Union. The press, voicing as it does the more enlightened sentiments of the nation, is sympathetic toward labor. The students consitute a formidable force, as illustrated by the nation-wide protest against the Versailles award of Shantung to Japan. Both are fighting labor's battle, partly because they believe that labor should not be sacrificed to further the capitalist's ambitions, and partly because they consider labor too weak to enter the contest single-handed.

One important phase of the agitation touches the present social renaissance in China. The development of industries has opened to women many vocational opportunities. In fact, some banks and trade corporations in Shanghai are encouraging woman workers to become bookkeepers and accountants by offering them pay equal to that of male workers in the same occupations.

But the emancipation of women has on the one hand intensified labor competition and on the other hand stimulated public agitation for the worker's health and safety. Recently the press of Changsha (Hunan) and of Shanghai fought vigorously against the recruiting of female employees by the Hou Sen cotton mill of Shanghai. Though the employer declared that great economic distress in the province had prompted him to offer the contract as a partial relief for the poor, the press immediately opposed the employment of women as an indication of capitalistic exploitation. Chinese society, it argued, cannot tolerate the enslaving of a large number of women merely to facilitate the selfish accumulation of wealth.

Labor Organizations

Approximately 200,000 factory workers are now organized into various labor unions in different cities. Up to the present they have been the most successful of all workers in efforts to secure higher wages and better working conditions. Their organizations are the most efficiently conducted among all the labor organizations now in operation in China. Next to them, in numerical strength, are the miners and railway men, who number about 185,000. In most of the trades the craft guilds are active and the influence of the labor union is not strong. The agricultural workers, who are more conservative than the craftsman, are at the present time the least organized. No accurate estimate of the number of the last two classes of workers is now available.

Of the more successful labor unions, the Returned Laborers' Union, composed of the returned laborers from France, merits particular attention. Besides attempting to improve conditions of employment, the union has a program of wide scope. While in France, thousands of the workers abstained from drinking and gambling in order to send their humble savings to support elementary schools in their home villages, and now the organization feels the wisdom of encouraging temperance and other character reforms among the workers on a large scale. Furthermore, the union isolates itself from politics in order to insure a free and unhampered development along purely industrial lines. With these broad objectives in view, the union makes the following declarations :—

> *Aims.*—The principal aims of the union shall be to co-operate with the workers to strengthen collective bargaining, to increase common knowledge through frequent association, and to promote a cordial but non-partisan friendship.
>
> *Resolutions.*—The members are resolved not to drink alcohol, or to visit prostitutes, or to gamble, or to smoke opium or use its derivatives.
>
> *Claims.*—The union claims the right to strike for improved working conditions, and the right to hold meetings or to make public speeches for promoting public welfare of the workers.

The union elects a chairman, a secretary, a treasurer, and ten councilors to take charge of various activities of the organization.

Yellow River Bridge

We have already informed our readers that the competitive design and tender for this work was awarded to a Belgian combination made up of the Societe d'Etudes et de Construction, the Societe Belge de Chemin de fer en Chine, and the Compagnie Generale de Chemin de fer et de Tramways en Chine. Of these companies the two latter are well known in China; for purposes of the bridge the first-mentioned is the active member, and the work of preparing the design and estimates was in its hands.

The Societe d'Etudes et de Construction was formerly known as the Societe Anglo-Belge de Construction and is a subsidiary combination between Messrs. S. Pearson & Son (Contracting Department) Limited, of London, the well-known contractors for public works and the Compagnie Belge de Chemins de fer et d'Entreprises of Brussels (formerly Compagnie Generale de Chemin de fer Secondaires) a well-known firm in railway engineering.

Two designs and tenders were prepared in mutual consultation, one by each of the above firms; that of the larger spans by the Compagnie Secondaires known as "A" design, and a more economic design with more moderate spans known as "B" design by Messrs. Pearsons. It is to the latter design that the first place has been awarded.

The consulting engineers for the projects sent in by the combination were Sir Ernest Moir, Bart., of Forth Bridge renown, M. Clavier, Grand Cordon de l'Order de Double Dragon de Chine, who built the existing bridge over the Yellow River, and Mr. T. J. Bourne, C.B.E., who for over 30 years has been associated with Chinese railways, who built the Huai bridge at Peng Pu, and was in charge of the designs for Messrs. Pearson. The firm of Pearsons is known to the Chinese as the Ta Cheng Kung Ssu. It will be of interest to our English readers to know that British interests are associated with this new and important work.

Engineers' Club (London)

Whilst the writer was in England last year a project was on foot for forming an engineers' club in London. The scheme met with immediate support and it was decided that membership should be made as wide as possible and include those engaged in the design, superintendence, direction or control (technical or commercial) of engineering and its allied industries, such as metallurgy, chemistry, architecture, etc.

The following subscriptions were proposed:—Town members: £10.10.0. per annum; country members, £5.5.0. per annum; overseas foreign members, £2.2.0. per annum

Some difficulties have been met with, but the club was officially opened on September 1st, 1921, at the premises of the Road Club, 39 Coventry Street, near Picadilly Circus, which have been taken temporarily for the purpose. The membership already exceeds 2,000 including a number of overseas men.

A commencement in this manner was considered advisable because the present is not an opportune moment for a scheme involving heavy financial outlay and even were it possible to start building suitable premises two years or so would probably elapse before the club could be got going.

The final premises decided on will have bedroom, lunching and dining accommodation as well as smoking room, billiard room, writing room, card rooms, etc. Ample sleeping arrangements are a cardinal feature of the scheme, and provision for the welfare of overseas members will be a foremost item in the organization.

The writer felt that the foregoing facts should be brought to the notice of interested parties in China and he has been provided with official forms and authority to take the present action. Membership application forms can be had from: Mr. H. J. SMITH, M.I. Mech. E., c/o General Electric Co. (of China), Ltd.

The Statistical Aspect of British Railway Operation Methods

(Contributed)

THAT comparisons are odious is unquestionable, but that they are instructive is some times overlooked especially by a conservative race. In any case the contrast of vital railway operation statistics on which labor conditions have little or no bearing gives much food for astonished thought when the railways of the United Kingdom are considered vis à vis other countries.

Take the case of that most vital of all railway operation figures average tons per train. The following table is illuminating :—

		Average Tons per train	
United Kingdom	March 1921 ..	123.52 tons	Cape Gov'nt Rlys.
	July 1920 ..	135.35 tons	
United States	.. .. ..	445	1916 142 tons
India ..	.. ..	189	
Japan (1918 ..	.. .. ..	142.6	128 (1916)
Germany	.. ..	240	
Chinese Government Rlys (1919) ..		270	257 (1918)

The arresting fact here is that the British railways in this respect are to be classed below Japan, a narrow gauge country. An examination of the factors controlling tons per train merely confirms the suspicion that railway operation in Great Britain leaves somewhat to seek.

Tons per train is controlled largely by gauge limiting gradients, rail weight, rolling stock equipment, empty wagon mileage and full loads when trains are run.

With regard to gauge railways of the United States, United Kingdom, China and Germany are standard 4-ft. 8½ and 2-ft. with negligible exceptions. India has four gauges 5-ft. 6-in., metre and 2-ft. 6-in. the various approximate mileage under each on the 1919 report being 16, 742, 13, 226, 2650, 638 while Japan and South Africa have a 3-ft. 6-in. gauge with a considerable mileage of 2-ft. 6-in. gauge the mileage of 3-ft. 6-in. gauge in Japan being 6,125 and that of the narrow gauge 1,465. The effect of gauge on train load for gauges of a metre and upwards is slight for, given the rail and weight, locomotives can be designed to handle loads up to the full capacity of the rail, but for gauges below this conditions of stability and the necessity of limiting piston speed have a decisive effect on design which increase rail weight cannot counteract. The most vital effect of narrow gauge is its effect on line capacity owing to lower speeds.

From the previous paragraph it will be observed that the British railways suffer no real handicap from the gauge question, and the same conditions obtain with regard to limiting gradient the ex-European Railways in the list operating considerably heavier grades on their first-class lines. Thus in China limiting grades for easy country are 1 in 150 while in mountain districts 1 in 30 is allowed, two such railways being included in the report for China from which the figure of 270 tons per train is obtained. Again Japan is hampered by a limiting gradient of 1 in 40 on important lines and also has to operate at least two rack sections. while the Indian Railways are handicapped by limiting gradients of 1 in 80 for the 5-ft. 6-in. gauge line, 50 for the metre and 1 in 30 for the 2-ft. 6-in. Practically similar conditions are met with in South Africa where grades exceeding 1 in 40 are operated and 1 in 40 is the ruling grade throughout the country.

In the matter of rail weight the most vital factor after gradients in its effect on train load the home railways occupy an exceptional position, the 90 to 100-lbs. rail being general and the 80-lbs. rail rather exceptional for first-class lines. The railways contrasted have the following rail weights :—

United States 80 to 100-lbs.—85-lbs. being general.
India 79 to 100 on the 5-ft. 6-in. gauge, 50 and 41 on the metre gauge, 30-lbs. on the 2-ft. 6-in.
Japan 60 to 75 on the 3-ft. 6-in. gauge.
Germany about 85-lbs.—18-ton axle loads.
China 85-lbs.
South Africa 80 to 60 the mileage under 80-lbs. rail being comparatively small while a 35-lbs. rail is standard on the 2-ft. gauge lines.

The effect of rail weight on train load is, of course, to cut down the allowable axle loads on locomotive drivers thus limiting adhesion and haulage capacity. While it is recognized that there are other vital factors effecting average train load such as empty wagon mileage, gradients, etc., the following table for three Indian gauges is unquestionable illustrative of this effect :—

Railway	5-ft. 6-in. gauge Rail Weight	Train load
Bengal Nagpur	90	298
B. B. & C. I.	69	310
East Indian	85	317
G. I. P. Railway	100	215.5
	Metre Gauge	
Assam Bangal	50	109
Bengal A. Western	50	113
B. B. C. I.	41½	137.3
Burma	50	138.9
	2-ft. 6-in. Gauge	
Nagpur Chindwara	30	78.3
Kalka Simla	30	22.3
Trans Indus	30	25.2

The above figures are for the first half of the year 1917-18. This table also sufficiently indicates the effect of gauge and rail weight on reducing the average train load for a country such as India with a considerable mileage of mixed gauges. Yet India as a whole shows a better average by over 60 tons than the British railways equipped to more or less uniform and infinitely superior standards. In the case of the United States, Germany and China countries where equipment is more or less to home standards it will be observed that average tons per train is enormously in excess of that obtained in the United Kingdom. In the case of China this average is much reduced by inclusion of a metre gauge line operating traffic over a line equipped with a 56-lbs. rail and having a limiting grade of 1 in 48. Yet the average of this line in 1918 was 105 tons per train.

The mileage of 2-ft. 6-in. gauge in Japan and 2-ft. 0-in. gauge in South Africa would also, of course, have a lowering effect on average train load.

The effects on train load of rolling stock equipment empty wagon mileage, are so closely related that they will be dealt with as a whole.

Thus in the first place it is obvious that necessary equipment is limited by line capacity in the first place, that is number of tracks and if single tracks frequency of crossing places. Line capacity again is further limited by average speeds. In this respect the British railways occupy a vastly superior position as practically all important lines have four tracks in congested districts with separate tracks for fast and slow goods, while single track mileage is almost negligible instead of being usual in the case of all the ex-European railways considered. The British railways should, therefore, be in a position to cope with a vast traffic with rolling stock of a total car capacity (for tonnage offering), giving far less margin than the other railways considered, for line capacity aside England must be a country of conspicuously short hauls. Average speeds must be considerably higher than lines in the majority of cases single tracked.

Further in the question of empty wagon mileage the British railways should be in a superior position to the railways considered for they are not faced with the problem of dealing with traffic which at certain seasons of the year sets in a fixed direction entailing long return hauls of empty stock. As there is no return tonnage the consequent reduction in average train load is enormous for these return train miles are totally unproductive, whereas the

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March a bad month. July 1920 figure is a better indication.

direct opposite must hold in Great Britain with its vast import and export trade. There should in England be always a high proportion of return tonnage and average train-load should show this which it certainly does not. The percentage freight upon capacity hauled in the United Kingdom should be considerably superior to any of the railways under consideration. The train-load figure indicates no such superiority.

Shortage of rolling stock might be alleged as an excuse for poor train load as in this case cars when unloaded must be hauled away at once wherever the demand is most immediate instead, of waiting for a load in the immediate neighborhood. This, of course, is conducive of excessive empty wagon mileage with consequent reduction in train load. With plenty of return tonnage as must be the case no such excuse can be advanced.

Further with conditions as above number of loads per car per year or annual tons per ton of car capacity should be exceptionally high on the British railways if cars are unloaded with promptitude and demmurrage rates made sufficiently exorbitant. So far as is known no figures for either percentage freight upon capacity hauled or number of loads per car per year are available for the British railways. On the Chinese railways, which are lamentably short of rolling stock and where the average haul for the system is 184 kilometres—115 miles (the least being 67 kilometres and the maximum 310 kilometres)—the number of loads per annum per car reaches the high figure of 75 the maximum being 204 for a short mineral line—45 miles average haul—and the minimum 31 for a line run at a loss. The time allowed for unloading on the Chinese railways is 12 hours.

In connection wih rolling stock equipment it is of considerable interest to contrast the equipment for dealing with traffic of varying density.

Country	Goods Traffic Tons per mile	Trains per day [*]	Engines per mile	Wagons per mile	Average haul
United Kingdom 1912	22,300	50.4	1	33.5	55.87[†] Mch. 1921
United States 1911	7,420	14.2	0.25	8.8	149 miles
Bengal Nagpur 1918	3,575	24.9	0.27	8.06	305 miles
Bombay Baroda 1918	2,400	23.	0.29	7.1	356 miles
East Indian 1918	9,300	41.7	0.51	12.4	385 miles

The above 3 Indian lines are 5-ft. 6-in. gauge.

Country	Goods Traffic Tons per mile	Trains per day [*]	Engines per mile	Wagons per mile	Average haul
S. Africa 1916 ..	1,460	10	0.17	3.13	184 miles
China 1918 ..	5,320	12	0.037	2	115 miles
Japan 1918 ..	9,370	27.2	0.543	8.8	103 miles

Country	Total Wagon capacity Tons	Number of loads per car per year	Per cent. freight on capacity hauled	Average capacity per vehicle tons.
Bengal Nagpur ..	233,000	30	50%	16.5
Bombay Baroda ..	176,000	19.8	44%	18.7
East Indian	592,000	25.2	44.7%	17.0
S. Africa	547,185	24.6		20.6
Japan	467,021	107.5	51%	10
China	246,849	75 estimated	36.5%	24

Number of loads per car per year is, of course, obtained by dividing wagon capacity by total tons carried per year and if on the rather extravagant assumption that the average car capacity of goods vehicles in the United Kingdom is 10 tons it will be found that annual number of loads on the English railways is about 68 a very poor figure considering the enormous tonnage [§] available, the short haul and very high line capacity of the English railways. The figure means that the average time for each car to load, unload and travel is 5.35 days a figure indubitably capable of reduction for as volume of traffic increases so should number of loads per car per year and the tonnage per mile offering on the United Kingdom railways is enormously the greatest in the world. The number of loads per car per year should be at least twice what is surmised when the exceptionally favorable conditions are considered.

While it is recognized that it is impossible to dogmatise without an exact knowledge of local conditions the above freight stock statistics indicate that the Japanese railways are very efficiently run but that a higher capacity wagon as on te South African railways might be introduced with considerable economy a reform which must be introduced sooner or later on the British railways.

The following table indicates the percentage dead weight to capacity for various classes of British-built goods coal wagons. Comment is superfluous :—

Capacity of wagon	Tare of wagon	Per cent. Dead Weight to capacity	
8 Tons	5.5 Tons	68%	
10	5.8	58%	
20	8.2	41%	
25	10.17	40%	
32	13.10	41%	Hopper wagon all steel
40	16.7	41.6%	,, ,,

Further the low percentage freight on capacity hauled for China's railways is an indication of higher empty wagon mileage as the result of inadequate rolling stock while the small number of loads per year on the Indian railways appear to indicate over equipment in spite of the very long hauls.

The question of what is adequate or inadequate in the matter of rolling stock is a particularly thorny one but it would appear that it should be considered from the following point of view. Thus take the case of a line equipped with 60-pound rail, single track with crossing stations at 5-mile intervals and with a limiting grade of 1 in 120. Goods trains on such a line would not exceed a car capacity of 400 tons and if we assume that freight is 50 per cent. of capacity hauled tons of freight per train should be 200. Then if the average haul is 100 mile each 100 miles of line should be equipped with a car capacity of 400 multiplied by the number of necessary trains obtained by dividing the daily tonnage available by 200 tons. This number of trains is, of course, limited by line capacity which is, say, 32 goods trains out of a daily total of 36—four being passenger trains—for a single line as above. Thus the maximum daily capacity of a single line as above is about 6,000 tons per 100 miles and for this 12,000 tons of car capacity is required of Number 4/30 tons cars per mile. Passenger stock can be treated on the same basis with an assumed relation between seat mileage hauled and seats occupied generally about 25 per cent. The above, of course, assumes a daily motion of 100 miles per car and neglects stock not in motion. This might be true for passenger stock only on double-track lines but for goods stock is incorrect for single-track lines at least and probably double track. Thus in the U.S.A. daily movement per wagon is 28.1 miles with a 30-ton load while in Japan it is 58 miles and in England about 15 miles and 1 ton. Figures for goods stock should thus be increased.

Without many essential statistics either not available or not recorded criticism or even intelligent interest in the operation of the British railways is an impossibility. All that can be surmised from the very favorable conditions under which British railways are placed in the matter of gauge, rail weight, line capacity, short haul, etc., is that trains are either not loaded to capacity, or that empty rolling stock is not used [‡] or, unnecessarily moved, or again that there is excessive delay in loading or unloading stock. If the need for rapid transit of goods is conducive of running trains which are neither loaded to full capacity of stock hauled nor to the haulage capacity of the locomotive then those interested on railway transport should be called upon to bear one more hardship that of running business on larger stock, but it is not believed that this can be the cause of much uneconomical running for the bulk of the tonnage carried must be minerals or manufactured goods for which rapid transit is not urgent. For such commodities there can be excuse for running under-weight trains.

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[*] This figure obtained by dividing daily train miles into mileage is for all classes of trains. Goods trains per day on the three Indian lines are 10.3, and 17 while in China and Japan the figures are 6 and 9.

[†] Coal, coke and minerals the bulk of tonnage 46 miles only. Train miles per train hour 8.86. Train miles per engine hour 3.36 for freight traffic.

[§] Freight ton miles month of March 1921 1,209, 571, 140.

[‡] This is a probable corollary of private wagon ownership.

The question of rapid loading and discharge for mineral traffic can be dealt with by the introduction of the high capacity hopper wagon with high level facilities for bin discharge, while for small consignments the introduction of fast electric traveling cranes of the gantry* type spanning several sidings should surely be feasible. Further it would appear to be advisable to throw the onus of collection and delivery perhaps even discharge and loading of cars on transport companies or even consigners or consignee.

Other obvious reforms applicable to all new work and renewals are as follows :

The substitution of the flat-footed for the bull-head rails. With the 90-lb. 30-foot rail with 12 sleepers under this would effect an economy in chairs of 90 tons of cast iron per mile valued at least £1,300 at the present price of pig iron.

The introduction of the high capacity wagon for reasons previously detailed and for the economy effected in shunting and marshalling, etc. The introduction of the Janney or other automatic coupler which would eliminate much of the risk† incurred by shunters and facilitate more rapid movement of cars. Further this reform would render the feasible introduction of the continuous brake for all stock, another change making for increased speed of operation.

As regard personnel the following table provides a contrast :—

Country	Year	Employees per mile	Employees per 100,000 train miles	Train Per day
United Kingdom	1912	Total 26 P.W. Dept. 2.83	147	48.5
Canada	1915	,, 3.37	199	
United States ..	1916	,, 6.25 P.W. Dept. 1	128	14.2
France	1912	,, 13.9	139	
India	1915	,, 17	382	
Japan	1918	,, 20.8 P.W.D. 2 to 3	213	27.2
China	1918	,, 18.5 P.W. Dept. 6.1	435	12

These figures seem to indicate that there is room for economy if we contrast the figures for the United States and ourselves making allowance for the greater traffic density. The superiority of the United States is without doubt due to the use of machinery to a greater extent than is customary with us a remark perhaps still applicable to most of out industries. This consideration apart it would be appear that considerable reduction could be made in the permanent way department.‡

With regard to locomotive performance the following statistics indicate no bad performance for the home lines :—

United Kingdom	1914	25,300 miles per locomotive per ann.
United States ..	1914	27,300 ,,
Japan	1915	26,600 ,,
China	1918	29,700 1919 29,783 ,,

Other minor reforms which would effect considerable economy are the institution of the Pullman car system giving much greater seating capacity per passenger car. Another necessary innovation should be modern coaling plants on the hopper system for fuelling engines. Something should be done to stimulate interest in the study of railway economics, a branch of railway science totally neglected in British educational institutions as is also the study of railway location, which receives equally scant attention while being perhaps the most vital importance. There can be no greater mistake than the supposition that an efficient surveyor is qualified to locate a railway.

Nationalisation has been definitely decided against for the grouping system but for those opponents of the principle the following facts are presented in refutation of the fact that absence of competition is conducive of inefficiency and stagnation.

The Japanese railways were nationalised in 1906 when the total mileage was 4371 miles. The mileage at the present is just under 6,000 miles while enormous betterments have been carried on in the interval. Passenger traffic has more than doubled itself and the cost of transport has fallen, while goods traffic is more than four times its original volume with a considerable fall in rates as well. Rates have fallen as follows :

	Year 1906		Year 1916
Passenger fares ..	Y.0.0155	per mile	Y.0.0134
Goods rates ..	Y.0.0199	per ton mile	Y.0.0166

In other respects the following statistics indicate at least that government control has done no harm.

Year 1906	Average total load per goods wagon	7.1 tons	
Year 1916	,, ...	9.9 ,,	
Year 1918	,, ...	11.6 ,,	
Year 1906	Average load per train .	71 tons	Number of cars 20
Year 1916	,, .	128 tons	Number of cars 28
Year 1918	,, .	142	,, 28

The above figures speak for themselves.

Again the government railways of China have been uniformly and increasingly prosperous in spite of the fact that the system of foreign loan agreement under which the system has been constructed tends towards uneconomic de-centralisation and plurality of officials. There are, for instance, in a system totaling 3,465 miles 14 separate administrations ascribed mainly to this cause yet the return on capital invested was 10.9 per cent. for the year 1918. The Peking-Mukden Railway the nucleus of the system has paid dividends of the order of 20 per cent. since 1905.

The system of nationalisation has also been applied to the railways of South Africa. They are at any rate solvent and pay dividends which have risen from just over 3 per cent. in 1914—a slump year—to just under 5 per cent. (£4.13.0 to be exact)—in 1916.

Unquestionably nationalisation would eliminate much competitive and wasteful construction, it would do away with traffic canvassing, and reduce enormously the cost of advertisement while considerable economics could indubitable be effected in personnel. Thus there is very little question that the numerous privately owned stations serving each of the great cities of the country are an extravagance as much now as when built for they occupy much wanted land and must be very costly in the matter of interchange traffic. There is little question that they would never have been allowed under a centralised control. As regards personnel the consolidation of 132 companies cannot fail to effect economies of which the elimination of directorates drawing £200,000 a year must be considered by no means the most important.

The great benefit of nationalisation would be the introduction of co-operative working between the railways and the common use of rolling stock. The system of private wagon ownership must be eliminated for efficiency of working and economy of national capital. Further there is unquestioned need of centralised control of routes to be followed and ports of destination to ensure economic distribution of work for the railways and the avoidance of unnecessary congestion.

While it is recognized that reform is a slow and painful process the large deficit for the year 1920 is a sufficient indication of its urgency. Under the stimulus of a great war Great Britain is said to have revolutionised her industries and she would do well to immediately follow the American example of 1866 and apply the same process to the railways. Without railway efficiency British industries cannot be thoroughly modernised ; cheap and abundant fuel and efficient transport are the life blood of a country.

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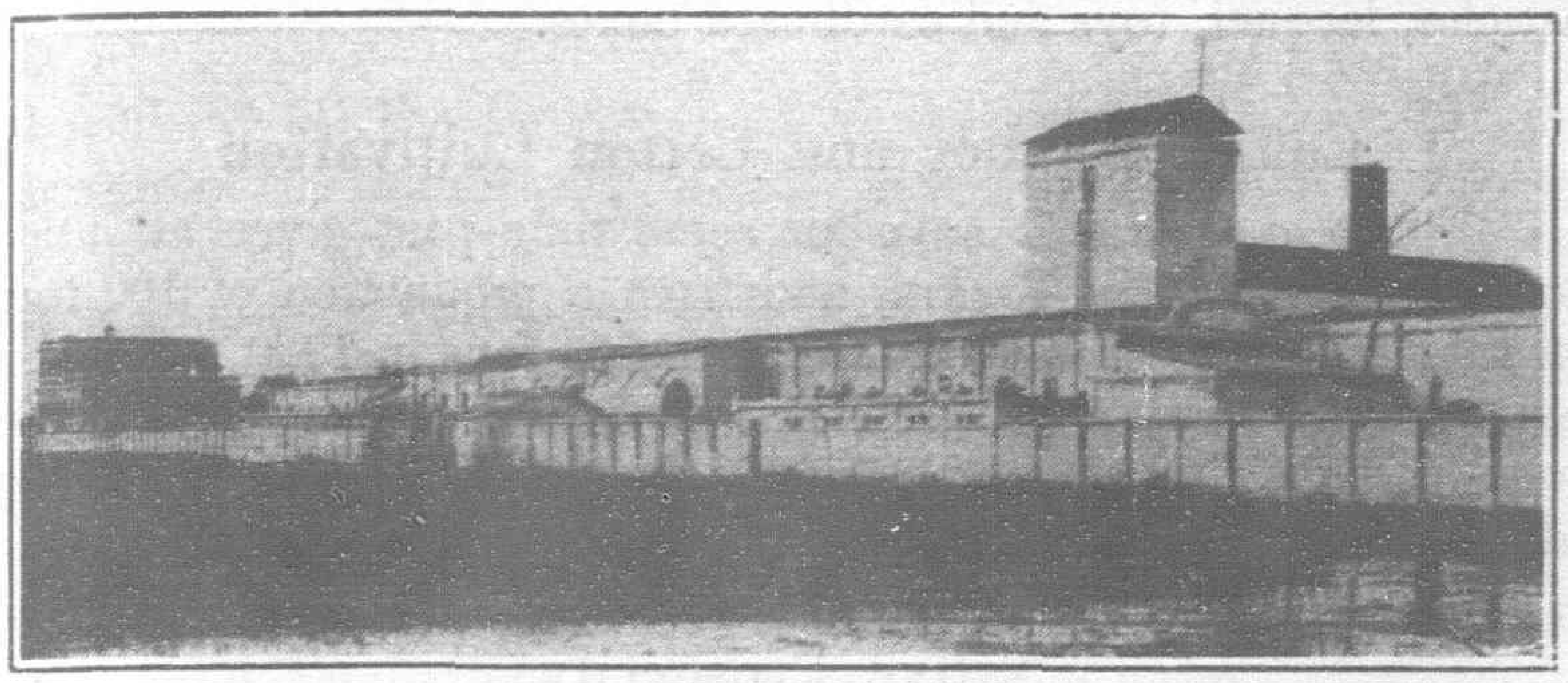
* This would only be applicable to loading open cars.

† In 1910 1 in 553 shunters employed were killed and 1 in 10 injured. The total shunters employed was 13,381.

‡ British track is incomparably the best in the world. It is over excellent and uneconomic.

Industrial Progress in Indo-China

INDO-CHINA is held to be France's richest colony. Throughout the country are grown rice, sugar and cotton; the south produces, in addition, pepper, copra and rubber; and the north, tea, coffee and maize. There are large teak forests in Laos, pine forests in Cambodia, and various species of building woods are found in Annam. These forests supply a number of by-products, such as gums, resins, varnishes, etc.



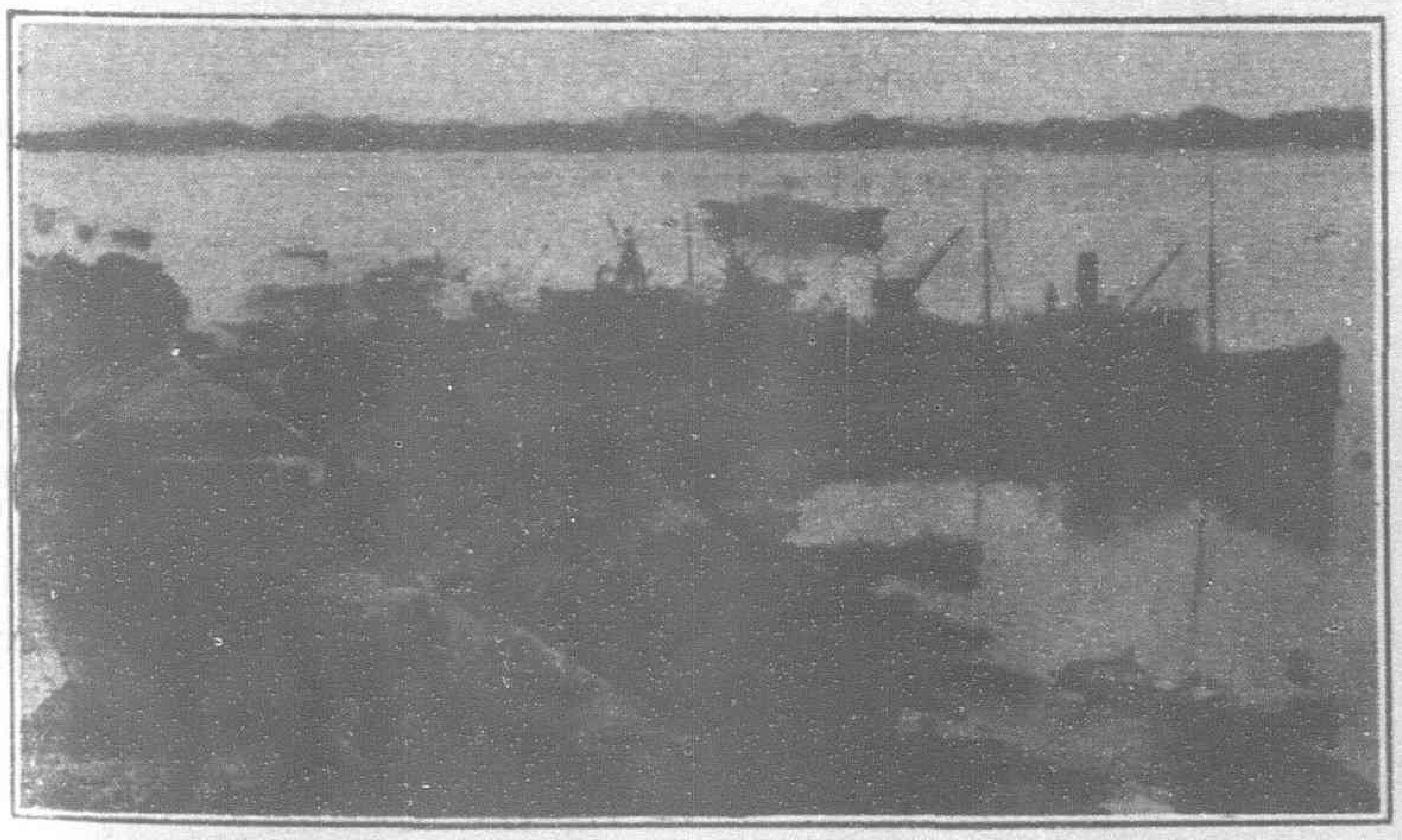
Cotton Mill at Haiphong

The country, and especially Tonkin, is rich in minerals; coal, iron, zinc, lead, tin, gold, wolfram, copper and silver being found there; in Annam there are coal, iron, gold, antimony and graphite; and in Laos, copper, silver, gold, tin, lignite and iron.

The population is dense only in the deltaic plains and round the river mouths, and is very sparse in the hilly forest clad regions of the north. The entire population of Indo-China is estimated at from 16 to 20 millions, though the country is rich enough to support 100 millions. An example of the manner in which the country has advanced in one generation under colonization may be found in Haiphong, the chief port of Tonkin. This town did not exist in 1880, and has to-day 75,000 inhabitants, twenty-six factories and a harbor which is held to be among the best equipped in the Far East.

Transport Routes

There are over 2,500 miles of navigable streams and canals in Cochin-China and Cambodia in the south; while Tonkin in the north has 700 miles.



Coal Wharves at Hongay

The system of railways comprises a total of 1,200 miles of line, of which nearly one-quarter is in Chinese territory. It is, however, insufficient, and further lines are urgently called for, notably the completion of the coast railway and its necessary branch lines; the line from Saigon to Pnom-Penh and Bangkok, 500 miles; and the line from Hanoi to Bangkok, of which some 350 miles remain to be completed.

An interial loan of six million piastres is to be raised for the purpose of completing the construction of the coast railway between Vinh and Dong-ha, near Hué, in Annam. There will then only remain the Tourane-Nhatrang section to be completed to connect Saigon with Hanoi and Yunnan.

There are over 9,000 miles of motor roads in the colony, and the number of public motor services is increasing rapidly. The larger towns possess electric power stations. Saigon and Hanoi are both equipped with a system of electric trams, and the former has also a steam tramway.

Mining Industries

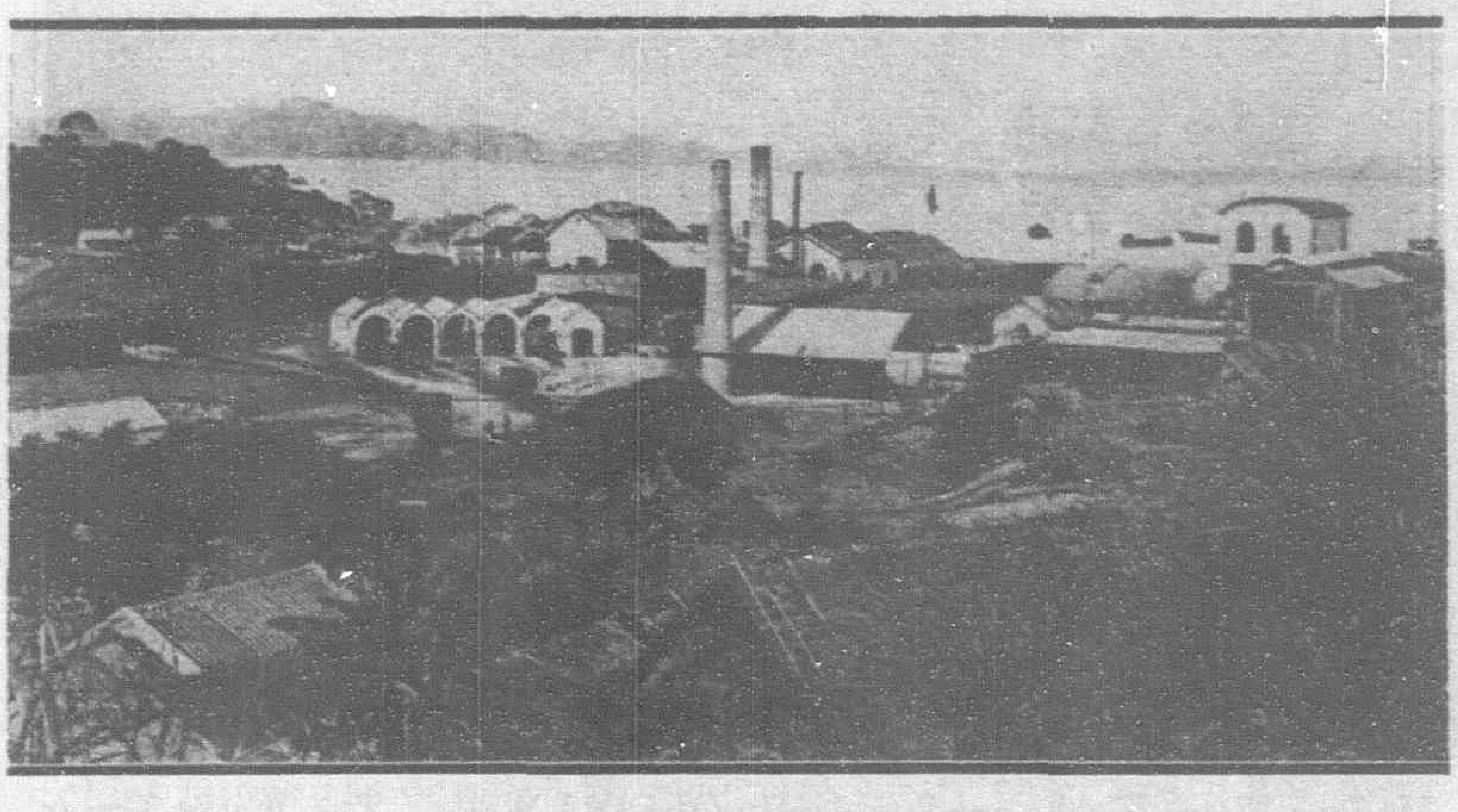
The principal coal mines are found at Hongay, in Tonkin, with an annual output of 750,000 tons. There are factories making coal briquettes at Dongtrieu with an output of 100,000 tons; at Tourane of 60,000 tons; and at Kébao of 40,000 tons per annum.

Zinc is produced at Chodien (14,000 tons per annum); at Tuyen-Quang (12,000 tons); Langhit (8,000 tons); and Pakvan (6,000 tons per annum). The mines at Chodien and Laughit are particularly well equipped in plant and machinery.

Rice Mill at Saigon

Tin and wolfram are produced at Pia-Ouac, the mines being worked by the most modern machinery.

Graphite is produced at Lackay and Quang-Ngai; gold at Bong-Mieu; iron at Thai-Nguyen and Thanh-Hoa; lead at Tuyen-Quang; phosphates in Tonkin and Cambodia.



Briquette Plant at Hongay

Other Industries

At Haiphong, in Tonkin, is a cement factory; there are also five rice mills, five machinery workshops, two tile factories, a soap factory, a perfume factory, an iron foundry, a cotton spinning mill, a glass factory, a brick and tile works, an aerated water factory, a porcelain factory and a coal briquette factory.

An Indo-China Automobile Route, at the entrance to Baria

Hanoi possesses a distillery and brewery, railway workshops, a match factory, two pottery factories, a tannery, a tobacco factory, a steam saw mill, a printing works, and porcelain, ice and aerated water factories. At Nam-Dinh there are a distillery and a rice mill, tile and brick works, a saw mill and engineering works and silk and cotton weaving mills.

At Vinh-Benthuy, in Annam, there are saw mills and a furniture factory, and the match industry is also established. Cement and pottery making are carried on at Hué and meat canning at Benthuy.

At Saigon and Cholon, in Cochin-China, there are fifteen large rice mills, two distilleries, an arsenal, four engineering yards, railway repair shops, saw mills, pottery works, oil works, match factories, breweries and mineral water factories, boat builders and paper makers.

Modern Water Works are Supplanting the Old Wells. The Water Tower at Baria, in Cochin-China

Saw milling, the manufacture of furniture, rice milling and silk weaving are industries of Pnom-Penh, in Cambodia.

The cement works at Haiphong produce 150,000 tons yearly, and will soon be able to increase this by 50,000 tons. Three thousand workmen are employed. The canning factory at Benthuy, in Annam, can handle 100 cattle or 500 pigs daily. The oil mills of Saigon can treat 6,000 tons of copra yearly, while the rice mills turn out 500 tons daily.

Native industries flourish, principally among the Tonkinese, whose embroidery and mother-of-pearl work are well known in the Far East. Among articles of utility, the Tonkinese manufacture leather goods, trunks and boxes, cane baskets and similar articles, lacquer, toys and cardboard boxes.

Coffee, Rubber and Cotton Cultivation

European colonists have for some time past given attention to coffee-planting in Tonkin, and from a production of 100 tons in 1914 have increased their output to 800 tons in 1920, while it is expected that the production will be further expanded to 2,000 tons by 1923. Rubber is grown in the south and the cultivation of cotton on a large scale is being undertaken.

Native Prosperity

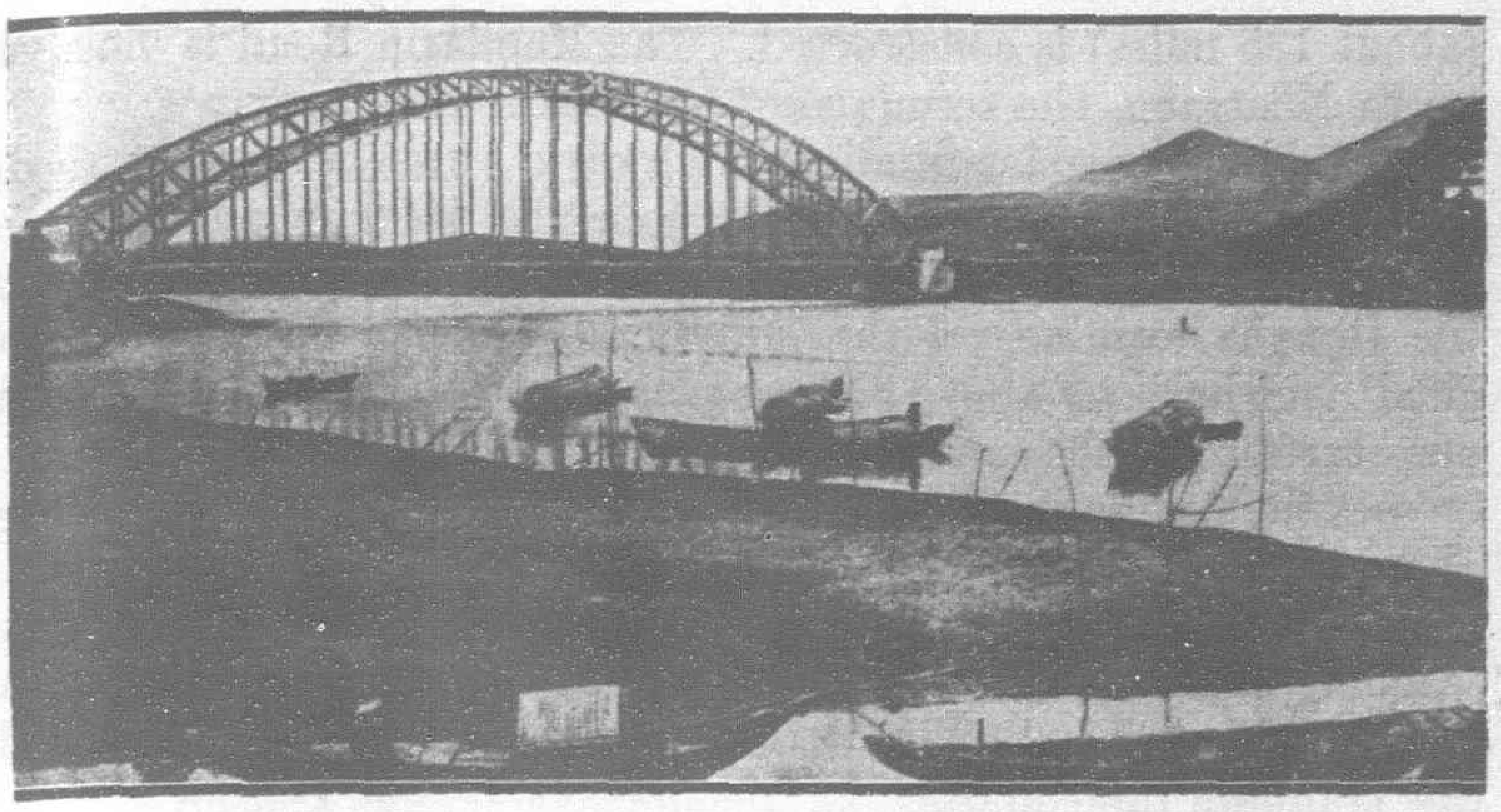
The purchasing power of the native inhabitant has increased enormously since 1914, particularly in the south, as much because he has made money and become accustomed to comfort and even luxury, as because his capacity for work and his initiative have greatly increased. There is a widespread desire for progress with a corresponding demand for equipment. In the north, however, especially in Tonkin, there is less money, and consequently a smaller demand for luxuries. There the inhabitants are anxious to provide themselves with irrigation installations, and water filtering apparatus, etc.

Splendid New Markets are found in all the Small Towns. The Market at Kiadaurnot

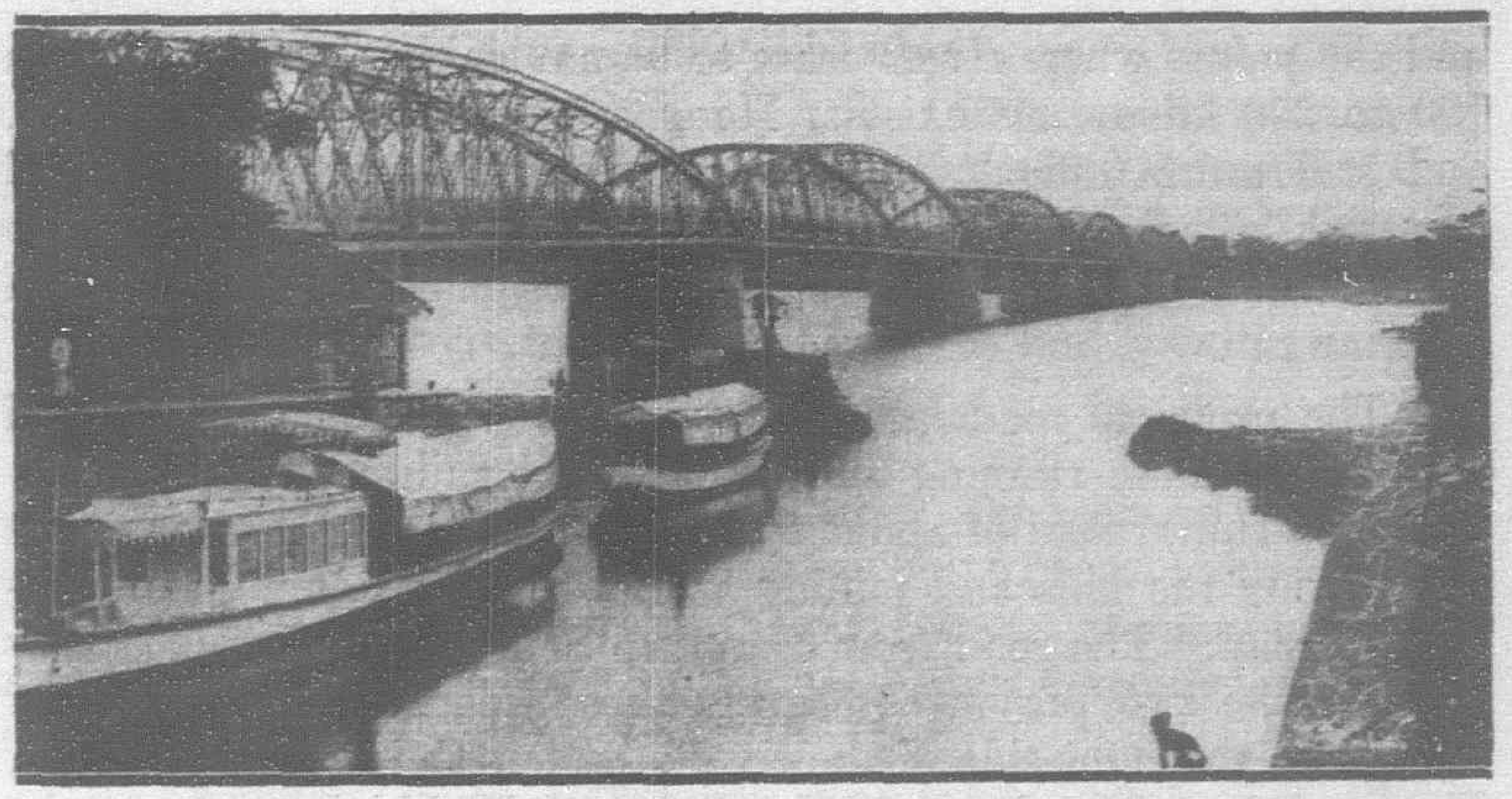
The spirit of initiative in Indo-China has greatly developed in recent years, and all recent enterprises, whether industrial or agricultural, have been characterized by breadth of conception.

Most Pressing Needs of the Country

It is of the greatest importance that the economic equipment of the colony should be completed by (1) the construction of rail and tramway systems and the development of commercial automobilism; (2) the construction of a mercantile fleet for the maintenance of commercial relations with China, Siam, the Philippines and the Netherlands East Indies; (3) the construction of a fleet



Railway Bridge at Ham-Rong, Annam



The Shan Shai Bridge at Hue, Annam

of colliers; (4) the improvement of the postal service; (5) the increase of the number of working mines and of mining apparatus.

In most towns there is great need of plant and material for electric lighting, ventilation and power, for an extension of existing railways, and the creation of new lines, especially in Cochin-China, where motive power is for the most part gas, drawn from the distillation of wood or waste.

There is an equally urgent need of material for the laying of water supply. The tendency in the more prosperous towns is to erect small installations for the purification of water.

In the agricultural districts, large schemes are in operation for draining the marshes and for irrigating the rice fields, especially in Northern Annam. Central electric power stations will be erected under these schemes at Hanoi (2,000 h.p.) and Thanh-Hoa (1,200 h.p.) for pumping where irrigation by gravitation is not possible, and the current will be distributed along the various canals and streams.

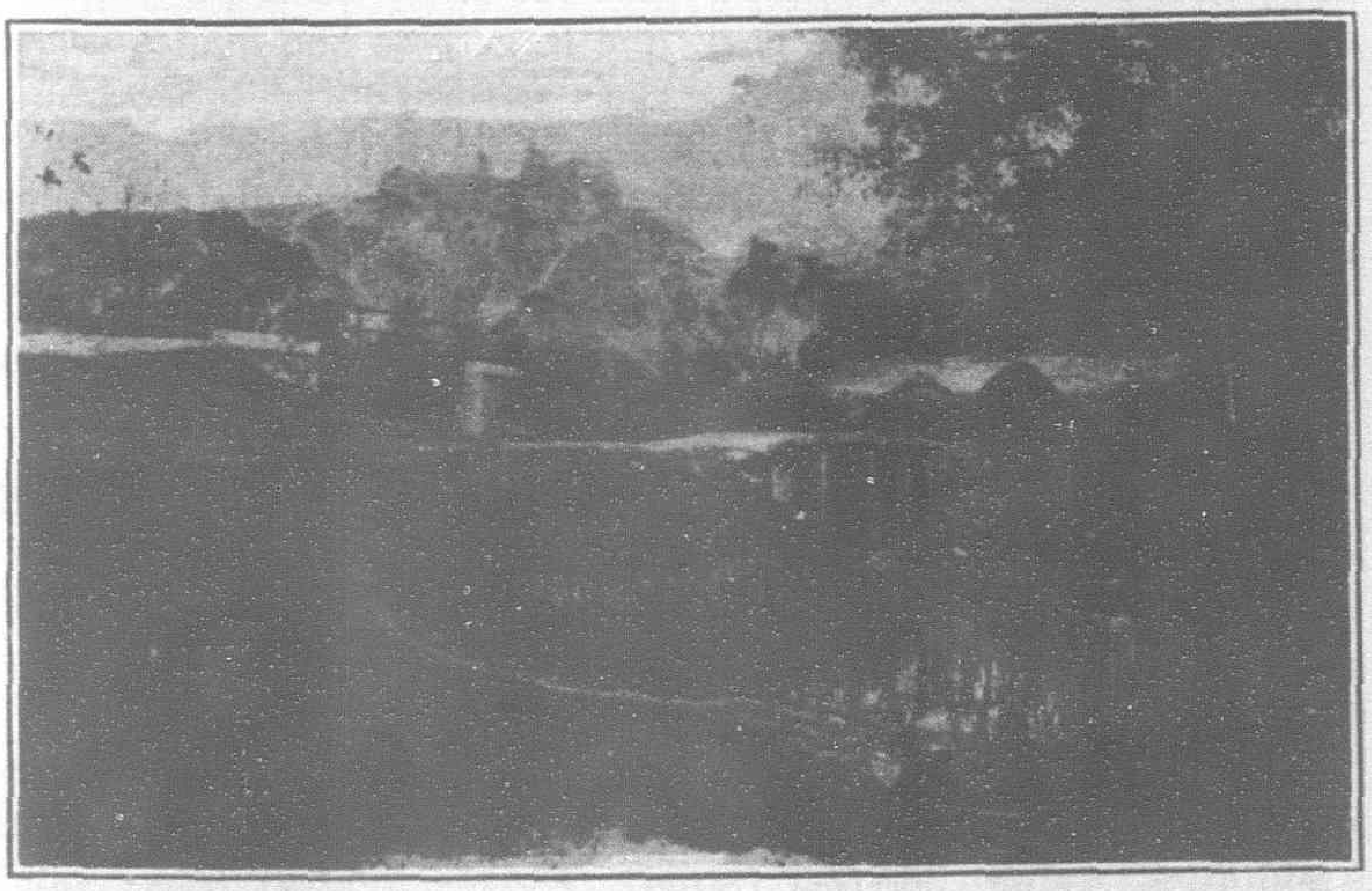
Banks

There are at present seven banks in Indo-China, as follows:

- Banque de l'Indochine (French) at Saigon, Pnom-Penh, Tourane, Hanoi, Haiphong;
- Banque Industrielle de Chine (French), at Saigon, Hanoi, Haiphong;
- Chartered Bank of India, Australia, and China (British) at Saigon and Haiphong;
- Hongkong and Shanghai Banking Corporation (British) at Saigon and Hanoi;
- Yokohama Specie Bank (Japanese) at Saigon;
- China and Southern Bank and the Banque Chinoise (both Chinese) at Saigon.

The Native Trade

In addition to the materials, machinery, etc., required in the conduct of the various industries and services dealt with above there are in demand among the natives cotton and black silks, stockings and socks of worsted and wool, boots and shoes (especially men's), clocks and watches, wristlet watches, alarm clocks, gramophones, umbrellas and sunshades, condensed milk (sweetened), chocolates, sweets and biscuits, etc.



New Road and Bridge at the Entrance to the Village of Cua Nhap

Trade in 1919

In 1919, the latest year for which figures are available, the commerce of French Indo-China was valued at 2,293 million francs, or 1,181 million francs more than in 1918, and 1,332 million francs above the average of the five preceding years.

In 1919 France and French colonies accounted for 15 per cent. of the entire commerce of Indo-China, as compared with 29 per cent. in 1910, foreign countries making considerable headway in the interim.

Roads in Indo-China

THE system of roads in Tonkin is in its infancy. In the early days of the French occupation of the country—and it must be remembered, when judging Tonkinese matters, that such occupation dates back only 33 years, and that the country was not really pacified until 15 years ago—the roads were naturally much neglected. In the low-lying part of the territory it was extremely difficult to build roads on account of the marshy nature of the ground, and also on account of the many large rivers and canals to be crossed, these being themselves used as means of communication. In the highlands, roads, although necessary from the military point of view, were not made, as mule paths were sufficient. Those paths, very seldom practicable for carriages, still exist throughout the whole country. The creation of a complete system of roads was only seriously commenced a few years ago. This meant a very large amount of work. In the delta the country lies very low, and is subject to inundation; therefore considerable earthworks are necessary for the establishment of roads. Besides, stone for ballast is not abundant; it has to be brought a great distance, so that the work, in spite of the cheapness of labor, is very expensive. Then the dykes, which were constructed several centuries ago, and must be continually raised to prevent floods, absorb a large part of the money available yearly for public works. It is therefore not astonishing that the building of roads in the delta should proceed slowly. In the highlands it is still slower, as numerous bridges, tunnels, cuttings, etc., are necessary, and labor is nearly everywhere lacking. Thus there are few roads in Tonkin and North Annam. They are not even sufficient to allow a complete tour of the country, and they would be insufficient for economic needs but for the great number of waterways which, in most cases, make up for the scarcity of roads. Then, too, many mines in the highlands lack sufficient means of transport. A very large development of the mining industry is expected when the chief mines are enabled to evacuate easily their ore. For most of them at present this is impossible, as between the mining districts and the points where rivers cease to be navigable a stretch of from 100 to 200 kilometres exists. Here it is very difficult to travel, and still more difficult to carry at reasonable rates goods and material. The only lines entering the district are the Hanoi to Langson and Nacham railway and the Haiphong to Laokay and Yunnan railway, and they are not sufficient.

The principal roads are in the delta—the Haiphong to Hanoi road of 63 miles, running mostly along the railway, and the Haiphong to Hanoi road of about 60 miles, following the border of the delta along the hills and joining at Bac-ninh the Hanoi-Phulangthuong road. The road from Hanoi to Sontay and Hunghoa goes through the two provinces bearing those names, to the north of Hanoi, on the right side of the river; its length is about 50 miles. The road from Haiphong to Nandinh and Ninhbinh traverses the whole delta, cutting across a number of large rivers, some of them over half a mile wide, and passing through the rich agricultural districts of Kien An, Haiduong, and Thaibing. It has a total length of 60 miles. The road from Nandinh to the sea runs 45 miles through rich agricultural plains and the salt district.

On the coasts of Tonkin and North Annam, the so-called, Routu Mandarin, which existed under he Annamese Government, and joined Saigon and Cochin-China to Hanoi and Tonkin through the whole length of Annam and through Hue, the capital of Annam, but which was not fit for carriage traffic, is being reconstructed on modern lines. The road is in good order where it is finished, and it is excellent for motor-car. Traffic is already substantial on the completed portion—that is to say, over 500 miles from Hanoi to Hué and Tourane and more to the south. When finished it will have, with the road to Caobang in Tonkin and the existing roads south of Saigon, a total length of about 1,500 miles.

In the highlands there is the road from Hanoi to Bac-ninh and Phulangthuong and Kep; it is partly on the plain, and goes as far as Langson on the Chinese frontier. That direction is now served instead by a railway. From Phulangthuong the road continues to the northeast towards Luc Nam and An Chau in a mountainous district, rich in mines and a good hunting ground; its length is about 100 miles. The road from Hanoi to Thai Nguyen and Backan, in very picturesque country, ends in a rich mining district, and is being pushed on as far as Caobang, the centre of the tin and wolfram mining district. A motor-car service joins Hanoi to Caobang; the total length being 111 miles. The road from Phutho on the Laokay railway to Tuyen Quang, with a regular motor-car service, has a total length of about 40 miles. The present terminus, Tuyen Quang, is an important mining centre. The road is to be extended farther north along the River Claire up to Hagiang; at present it is only serviceable for riders.

There are no other important roads, but the construction of highways has been rapid for the last three or four years, even during the great war, which has reduced the European staff. When normal times again prevail, it is probable that the mining districts and all important centres will be provided with proper means of communication.

Annam Roads

On account of the shape of the country, communications are mostly by sea. The ancient Annamese dug a very winding, and now more or less silted up, but still useful, canal for intercommunication by land in the three northern provinces, besides which, between Hué and Donghoi, communications were facilitated by a series of lagoons. The Mandarin Road, which ran along the whole of the coast from Saigon to Hanoi, was but a path. The trans-Indo-China railway and the new Mandarin Road will, however, establish uninterrupted communication between all the towns bordering that long ribbon of coast-line. The railway is in three sections. The southern section, from Saigon with its terminus at Nhatrang, is 280 miles long. The central section, from the port of Tourane to Hué and Donghoi, is 110 miles long. The northern section, from Nacham to Hanoi and Vinh Benthuy to Baiduc, has a length of 375 miles. The railway from Baiduc to Donghoi (about 135 miles) is constructed. The Mandarin Road is finished up to Nhatrang, the terminus of the southern railway.

Besides those longitudinal highways, three important roads have been under construction to join the Mékong and tap the highlands of Laos. The most important is 200 miles long, between the Dongha terminus of the central railway and Keng Kebao, a good river harbour above Savannaket on the Mékong. The second one starts from the northern railway line, 15 miles south of Vinh, crosses the Annamite Range near Nape in Laos, to join the Mékong above Pak Hinboon on the best navigable stretch of the river. That route is only 115 miles long, and has the advantage that seagoing launches are able to go right to its eastern terminus. A third road starts from Vinh to climb to the highlands of Laos and the Tranninh tablelands.

Mines in Indo-China

THE unfavorable economic conditions prevailing throughout 1919 seriously affected prospecting activities during the year, the number of new mining claims being only 189 with 39 renewals of permits. The special facilities conceded for the renewal of permits during the war were revoked on July 1st, 1919. The number of licenses now in force throughout the colony are distributed as follows: Tonkin, 451; Annam, 140; Laos, 24; Cambodia, 74; Cochin-Chine, 17. These figures do not include licenses automatically suspended by reason of the mobilization of their holders and of which no record has been filed with the mining bureau of the government.

During 1919 only four mining concessions were granted, two for working phosphates, one iron, and one zinc. The total number of concessions active on the 1st of January, 1920, was 226, distributed as follows: Coal, 63; zinc and lead, 90; lead and silver, 3; tin and tungsten, 30; gold, 12; copper, 9; iron, 8; antimony, 4; mercury, 3; phosphates, 4. Twenty-two requests for concessions were filed during 1919, and 185 of these requests were under investigation on January 1st, 1920.

Coal

The coal output of Indo-China remained almost stationary in 1919 or 665,000 tons against 636,000 in the previous year, or an average of 645,000 tons during the years of the war. The decrease in stocks from 400,000 to 300,000 tons and the proportionate increase in exports (from 250,000 in 1918 to 350,000 in 1919) brought about a marked improvement in the situation. The coal industry of Indo-China whose development was temporarily retarded by reason of the difficulties surrounding transportation resumed its forward march in 1920 towards the brilliant future that is confidently expected awaits it.

The development of the Phon-me coal basin has not justified the promises held out at first by the extent of the deposit and the exceptional quality of the coal, due largely to the inadequacy of the Sungcan River to serve as their natural outlet to the nearby town of Thainguyen.

The following is an official list of all the mines of Indo-China, with the names of their owners, locality and outputs for 1919:—

Coal Mines

Region of the Bay of Along

1. Hongay Coal Mines.—Province, Quang-yen. Owners, Societe Francaise des Charbonnages du Tonkin. Area, 23,000 hectares. Output, 520,000 tons. Value, 18,800,000 francs. Exports, 336,383 tons, value, 11,600,000 francs. Personnel, 53 whites, 6,188 natives.

2. Kebao Coal Mines.—Province, Quang-yen. Owners, Societe du Domaine de Kebao. Area, 25,000 hectares. Output, 9,866 tons, value, 360,000 francs. Exports, 5,530 tons, value, 230,000 francs. Personnel, 2 whites, 379 natives.

Region du Dong-trieu

3. **Francis Coal Mine.**—Province, Quang-yen. Owners, M. Coulet, M. Colonna d'Istria. Area, 374, hectares. Output, 7,500 tons, value, 150,000 francs. Exports, 600 tons, value, 10,000 francs. Personnel, 1 white, 40 natives.

4. **Hien Coal Mine.**—Province, Quang-yen. Owners, M. Darmoy, M. Colonna d'Istria. Area, 48 hectares. Output, 3,000 tons, value, 80,000 francs. Exports, 550 tons, value, 20,000 francs. Personnel, 1 white, 40 natives.

5. **Renne Coal Mine.**—Province, Quang-yen. Owners, M. Berthet et Charriere. Area, 880 hectares. Output, 18,268 tins, value, 400,000 francs. Personnel, 2 whites, 238 natives.

6. **Clotilde-Louise Coal Mine.**—Province, Quang-yen. Owners, Societe des Charbonnages de Dong-trieu. Area, 2,400 hectares. Output, 5,144 tons, value, 180,000 francs. Exports, 701 tons, value, 30,000 francs. Personnel, 4 whites, 165 natives.

7. **Fabien Coal Mines.**—Province, Quang-yen. Owners, M. Hguyen-dac-Ton, MM. Cathalan and Perinaud. Area, 724 hectares. Output, 13,560 tins, value, 400,000 francs. Personnel, 1 white, 214 natives.

8. **Chacha Coal Mine.**—Province, Haidoung. Owners, Cie Miniere et Industrielle de l'Indo-Chine. Area, 499 hectares. Output, 420 tons, value, 20,000 francs.

9. **Choedelin Coal Mine.**—Province, Haidoung. Owners, M. Sarran. Area, 1,190 hectares. Output, 14,689 tons, value, 540,000 francs. Personnel, 2 whites, 458 natives.

10. **Edouard Coal Mine.**—Province, Haidoung. Owner, M. Salle. Area, 726 hectares. Output, 20,799 tons, value, 550,000 francs. Exports, 3,500 tons, value, 80,000 francs. Personnel, 3 whites, 333 natives.

Region de Phan-me

11. **Louisette Coal Mine.**—Province, Thai-nguyen. Owners, Societe Miniere du Tonkin. Area, 1,600 hectares. Output, 11,314 tons, value, 450,000 francs. Character of coal, lump, with 23 per cent. volatile material.

12. **Co-Loung Coal Mine.**—Province, Thai-nguyen. Owners, Societe Miniere du Tonkin. Area, 2,400 hectares. Output, 5,103 tons, value, 200,000 francs. Character, same as above. Personnel of the two mines, 5 whites, 400 natives.

Region de Phu-nho-quan

13. **Paul Coal Mine.**—Province, Ninh-binh. Owners, M. Rey, Societe Francaise de Colonization en Annam-Tonkin. Area, 2,399 hectares. Output, 9,887 tons, value, 300,000 francs. Character of coal, semi-lump. Personnel, 2 whites, 223 natives.

Region de Tuyen-quang

14. **Alice Coal Mine.**—Province, Tuyen-quang. Owners, M. Dubreuilli. Area, 387 hectares. Output, 16,027 tons, value, 470,000 francs. Character of coal, lignite. Personnel, 2 whites, 197 natives.

Region de Cao-bang

15. **Henri Coal Mine.**—Province, Cao-bang. Owners, M. Vincenti. Area, 900 hectares. Output, 338 tons, value, 10,000 francs. Character, lignite. Personnel, 5 natives.

Region de Nong-son

16. **Nong-son Coal Mine.**—Province, Quang-nam (Annam). Owner, M. Debeaux. Area, 3,000 hectares. Output, 9,198 tons, value, 320,000 francs. Exports, 6,886 tons, value, 250,000 francs. Personnel, 2 whites, 55 natives.

Wolfram and Tin Mines

Region of Pia-ouac

1. **St. Alexandre Mine.**—Province, Cao-bang (Tonkin). Owners, Societe des Etains et Wolfram du Tonkin. Area, 680 hectares. Character of deposit, veins. Output, 83 tons wolfram and iron, not sold.

2. **Ste. Adele Mine.**—Province, Cao-bang. Owners, Societe des Etains et Wolfram du Tonkin. Area, 160 hectares. Character, alluvial. Output, wolfram, 133 tons, value, 400,000 francs. Cassiterite, 128 tons, value, 600,000 francs. Exported, wolfram, 40 tons, value, 120,000 francs, tin, 81 tons, value, 700,000 francs. Minimum mineral content of ore, wo 3-68 per cent.; sn 65 per cent. Personnel, 15 whites, 914 natives.

3. **Beausite Mine.**—Province, Cao-bang. Owners, Societe des Mines d'Etain du Haut Tonkin. Area, 500 hectares. Character of mine, alluvial and veins. Output, mixed, 61 tons, value, 220,000 francs. Exports, 10 tons, value, 35,000 francs. Minimum mineral content, wo 3-33 per cent.; sn 3-33 per cent. Personnel, 2 whites, 141 natives.

4. **Andree Mine.**—Province, Cao-bang. Owner, M. Phan-van Co., operating company, Societe Civile des Mines d'Etain et Wolfram du Pia-ouac Est. Area, 237 hectares. Character, alluvial.

5. **Alexandre Mine.**—do. Owner, M. Ng-van-vein, operating company, same as above. Area, 245 hectares. Character, alluvial.

6. **Robert Mine.**—do. Owner, M. Bui-xuan-Khoai, operated by same as above. Area, 245 hectares. Character, veins.

7. **Minos Mine.**—do. Owner, Me. Phan-thi-Dien, operated by above company. Area, 154 hectares. Character, veins.

8. **Man-muc Mine.**—do. Owner, M. Phan-van-Co, operated by above company. Area, 596 hectares. Character, veins.

Combined output of above group, 48 tons mixed; value, 150,000 francs. Exported, 78 tons mixed, value, 250,000 francs. Minimum mineral content, wo 3-43 per cent.; sn 22 per cent.; Personnel, 4 whites, 150 natives.

9. **Ariane Mine**, 288 hectares. **Phedre Mine**, 456 hectares. **Ganymede Mine**, 450 hectares. Province, Cao-bang. Owners, Societe des Mines du Pia-ouac. Character, alluvial and veins. Combined output of group, 59 tons, value, 190,000 francs. Exported, 56 tons, value, 186,000 francs. Minimum mineral content, wo 3-30 per cent.; sn 30 per cent.; Personnel, 2 whites, 127 natives.

Zinc Mines

Region de Tuyen-quang

1. **Trang-da Mine.**—Province, Tuyen-quang, Tonkin. Owners, Societe des Mines Trang-da. Area, 800 hectares. Output, 3,500 tons, value, 300,000 francs. Minimum mineral content. Personnel, 11 whites, 577 natives.

Region de Cho-dieu

2. **Rubis Mine.**—Province, Bac-kan (Tonkin). Owner, M. G. Bault. Area, 793 hectares. Output, 21 tons, galena. 9,476 tons zinc, value, 3,300,000 francs. Exported 1,000 tons, value 350,000 francs. Personnel, 7 whites, 568 natives.

Region de Song-nang

3. **Alexandre Mine.**—Province, Tuyen-quang, Tonkin. Owners, Societe des Mines de Pac-van. Area, 900 hectares. Output, 430 tons, value, 150,000 francs. Personnel, 7 whites, 225 natives.

Total Zinc Mines. 3 concessions. Area, 2,493 hectares. Output, 15,934 tons, value 4,750,000 francs. Exported, 1,000 tons, value, 350,000 francs. Personnel, 25 whites, 1,370 natives.

Iron Mines

Region of Phuc-ninh

1. **Ngoi-ton Mine.**—Province, Tuyen-quang. Owners, MM. Perrin Freres and M. Leroy. Area, 450 hectares. Output, 1,400 tons, value 20,000 francs. Ore, 61 per cent.

Region of La-phu

2. **La-phu Mine.**—Province, Phu-tho, Tonkin. Owner, Societe Anonyme Francaise de Colonisation en Annam-Tonkin. Area, 900 hectares. Output, 900 tons, value, 18,000 francs. Ore, 63 per cent.

REGION OF PHI-LIET

3. **ARGONNE MINE.**—Province, Haidoung, Tonkin. Owner, M. Nougaerde. Area, 900 hectares. Output, 200 tons, value, 2,000 francs. Ore, 40 per cent.

4. **KIM-BAO MINE.**—Province, Haidoung, Tonkin. Owner, M. Vu-van Co. Area, 900 hectares. Output, 150 tons, value, 2,000 francs. Ore, 45 per cent.

5. **CHAU-HAI MINE.**—Province, Kien-an, Tonkin. Owner, M. Nguyen-huu-Lan. Area, 900 hectares. Output, 1,400 tons, value, 10,000 francs. Ore, 35 per cent.

REGION OF DOANH-XA

6. **PAUL MINE.**—Province, Thanh-hoa, Annam. Owner, M. Rey. Area, 900 hectares. Output, 900 tons, value, 14,000 francs. Ore, 48 per cent.

REGION OF DO-CAM

7. **PRIOLA MINE.**—Province, Vinh, Annam. Owners, M. Malaurie, M. de Monpezat. Area, 900 hectares. Output, 150 tons, value, 2,000 francs. Ore, 48 per cent.

Total, Iron Mines: 7. Area of concessions, 5,850 hectares. Output 5,100 tons, value, 68,000 francs.

Phosphate Mines

REGION OF THAN-MOI

1. **ARTHUR BLANC MINE.**—Province, Langson, Tonkin. Owner, Societe des Phosphates du Tonkin. Area, 900 hectares. Output, 4,100 tons, value, 530,000 francs. Phosphate content, 44 per cent. Personnel, 1 white, 200 natives.

REGION OF KAMPOT, CAMBODIA

2. **MADELEINE AND MARGUERITE MINE.**—Province, Kampot. Owner, M. Mayeur. Area, 900 hectares each. Output, Madeleine, 2,500 tons, Marguerite, 450 tons.

Total Phosphate Mines: 3. Area, 2,700 hectares. Output, 7,050 tons.

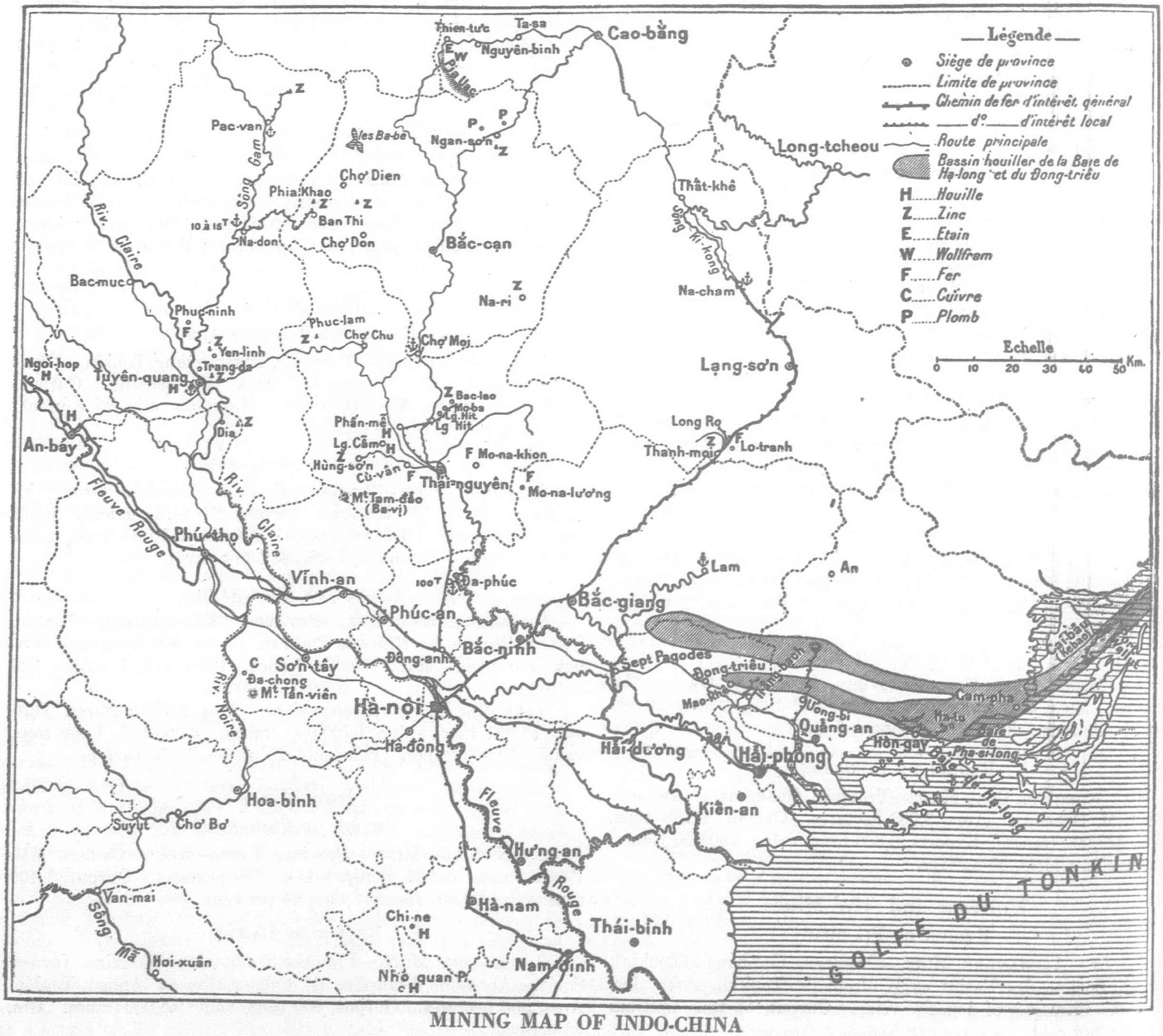
Graphite Mines

REGION OF HUNG-NHOUNG

1. **SEVERINE MINE.**—Province, Quang-hgai, Annam. Owner, M. Leoni. Area, 900 hectares. Output, 7,451 tons, value unknown. Exported, 7,451 tons.

REGION OF LAO-KAY

2. **LA BANNIERE MINE.**—Province, Lao-kay, Tonkin. Owner, M. Dumond. Area, 900 hectares. Output, 90 tons.



MINING MAP OF INDO-CHINA

Hydro-Electric Enterprises in Formosa

THE British consul at Tamsui, in a recent report to the department of overseas trade, gives a most interesting account of the development of hydro-electric plants in the island of Formosa. He says that the first hydro-electrical undertaking was initiated in 1902 by a company which was formed to utilize the falls of the Shinten River, in the Taihoku province, the object being to produce power for supplying light to the city of Taihoku. The Formosan government, however, decided to place the supply of electricity under its own control, and it accordingly took over the Shinten scheme. The first power station was opened in 1905 and a second followed in 1909, the two together having a total capacity of 4,000 horse-power. They were followed during the next few years by other power stations, as below :—

Year.	Situation.	H.P.	Towns supplied.
1909	Chikushinmon	2,000	Tainan and Takao
1911	Daian River	1,200	Taichu and Shoka
1917	Rono-kei (upper course)	4,000	Tainan and Takao

Lake Candidius Scheme

The industrial development occasioned by the European war brought about an increased demand for electric power, and a big project was formed to utilize the waters of the Dakusui River and of Lake Candidius, which is the largest lake in Formosa and lies almost exactly in the centre of the island. In order to facilitate the carrying out of this scheme, the Formosan government decided in 1919 to float a semi-official limited liability company to take over all the government's electrical undertakings. This company received a concession for the Lake Candidius scheme and commenced work in 1920. The date of completion is as yet somewhat vague; the year 1924 was at first spoken of, but it is likely that the actual date will be a year or two later. The estimated cost of the undertaking is Y. 48,000,000, apportioned as follows :

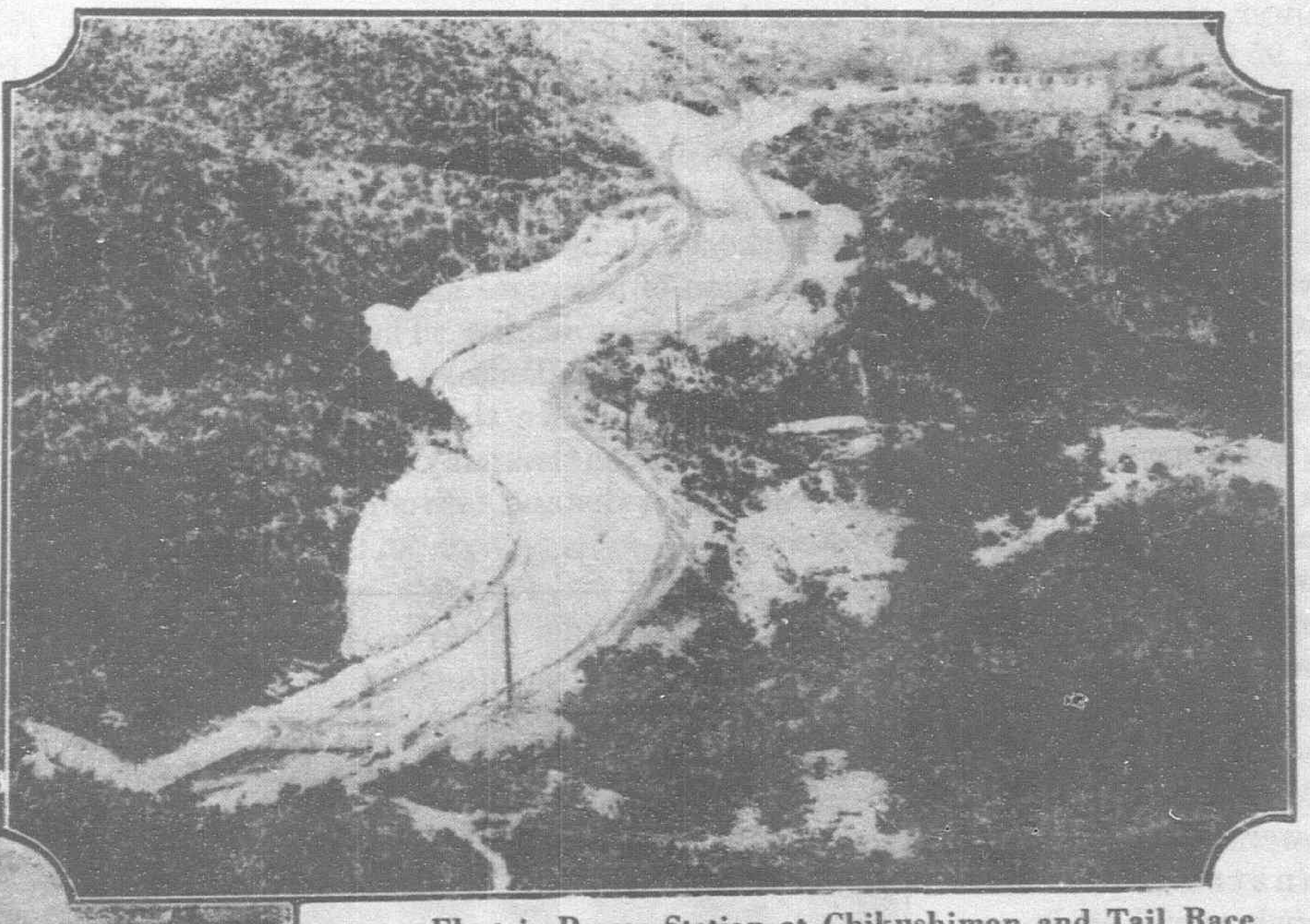
	Yen.
Civil engineering constructional work	19,900,000
Electrical constructional work	26,500,000
Business expenses	1,600,000
	48,000,000

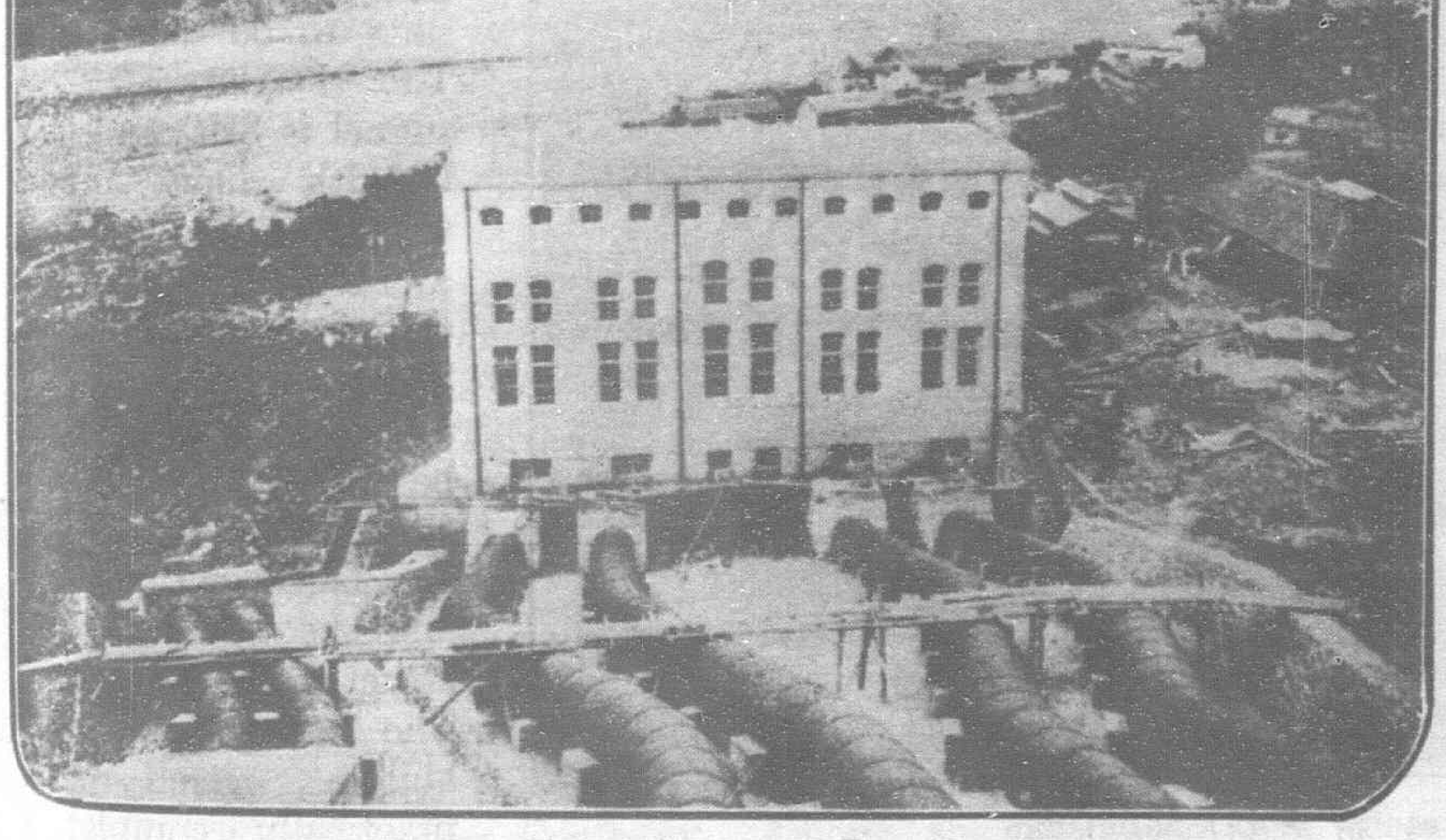
The scheme provides for leading water from the river Dakusui from an intake in the Shimaigahara region into Lake Candidius—the Japanese name of which is Jitsugetsutan—which will act as a reservoir for the water needed for the power station. The river Dakusui rises in the mountains of Central Formosa and makes its way first southwards and then turns westwards, passing within less than three miles of Lake Candidius, and on into the sea. The slatey character of the soil through which it passes in its upper course renders its waters muddy and gives it its name of "Muddy Water River." Candidius is a mountain lake some 6 square miles in area, lying at a height of 2,400-ft. above sea level. At present it is gradually drying up, but when the waters of the river are let in its surface will be raised 75-ft. The waterway from the river Dakusui to the lake will be 12½ miles in length, apportioned as follows :

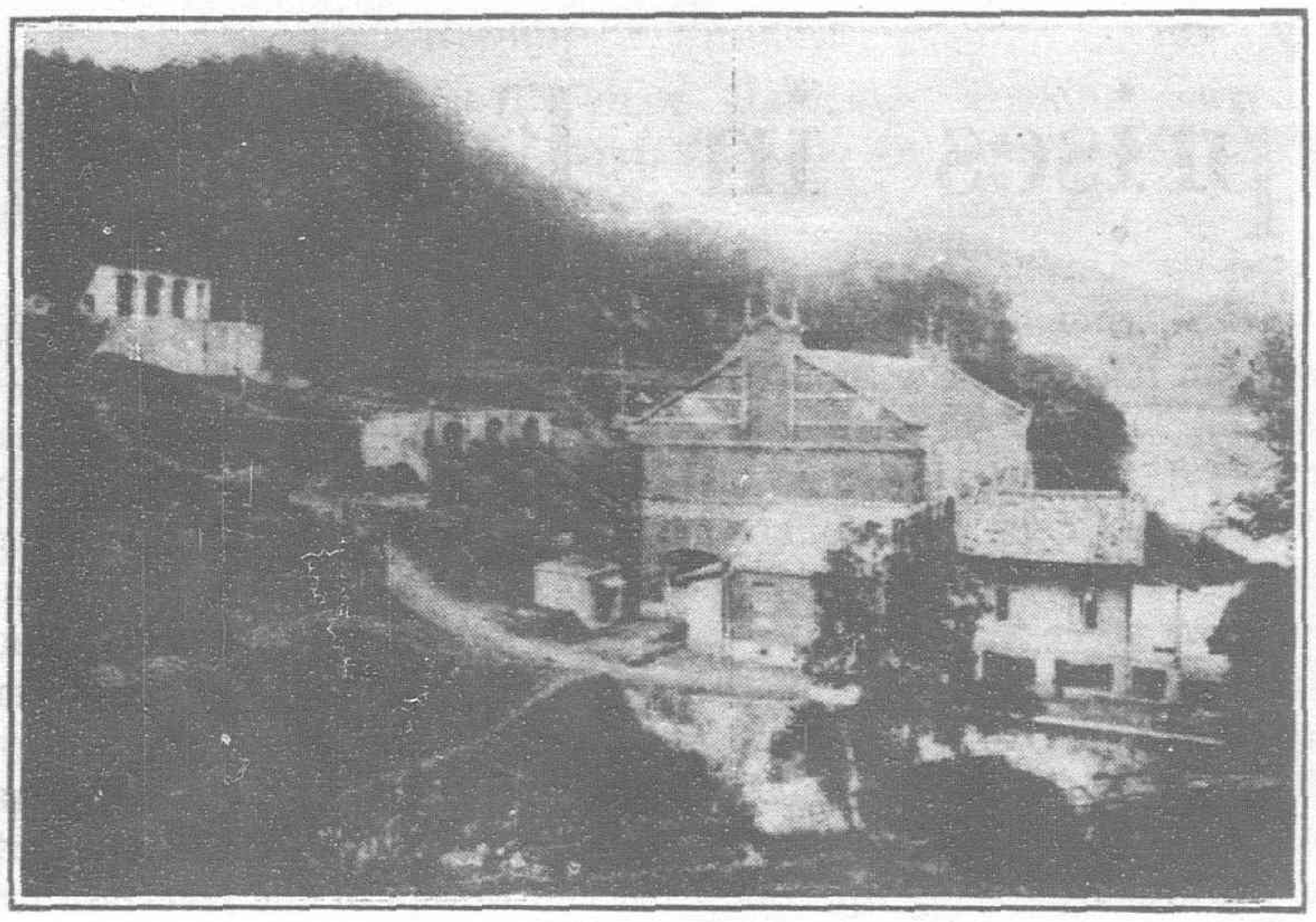
Nature of waterway.	Number.	Length. Yards.
Tunnels	12	19,364
Covered cuttings	5	1,236
Open cuttings	11	842
Aqueducts	6	402
		21,844

A settling pond is also to be constructed in the hope of depositing some of the mud and sand carried by the waters, since the river water in its present condition would mar the beauty of the lake, and it is feared, moreover, that it might kill the fish which exist in it. At two points on the lake's western shore, where the banks are low, dams will be constructed of the following dimensions :—Suisha dam: height, 100-ft.; length, 1,800-ft.; Tosha dam: height, 60-ft.; length, 1,000-ft.

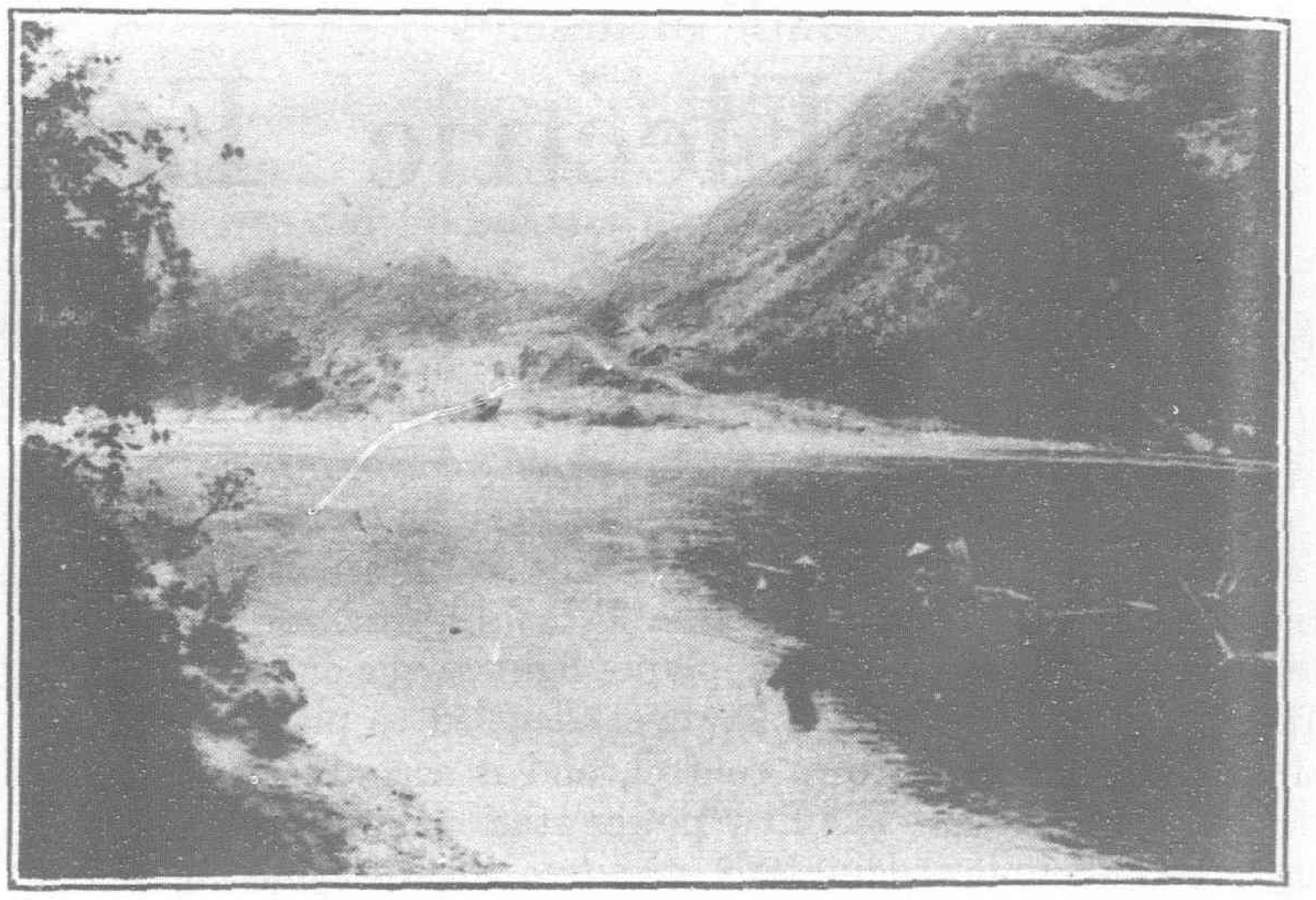
The water will leave the lake by a tunnel two miles long and will be taken down in pipes to the power station at Monpaitan, the fall being 1,100-ft. The volume of water at the intake on the river Dakusui will vary between a miuimum of 300 cubic feet per second and a maximum of 1,600 cubic feet, or an average of 954 cubic feet, which, it is calculated, should allow a steady flow at the exist from the lake of 900 cubic feet per second.


Electric Power Station at Chikushimon and Tail Race


Electric Power Station at Doryuwan



No. 2 Electric Power Station at Kosoko

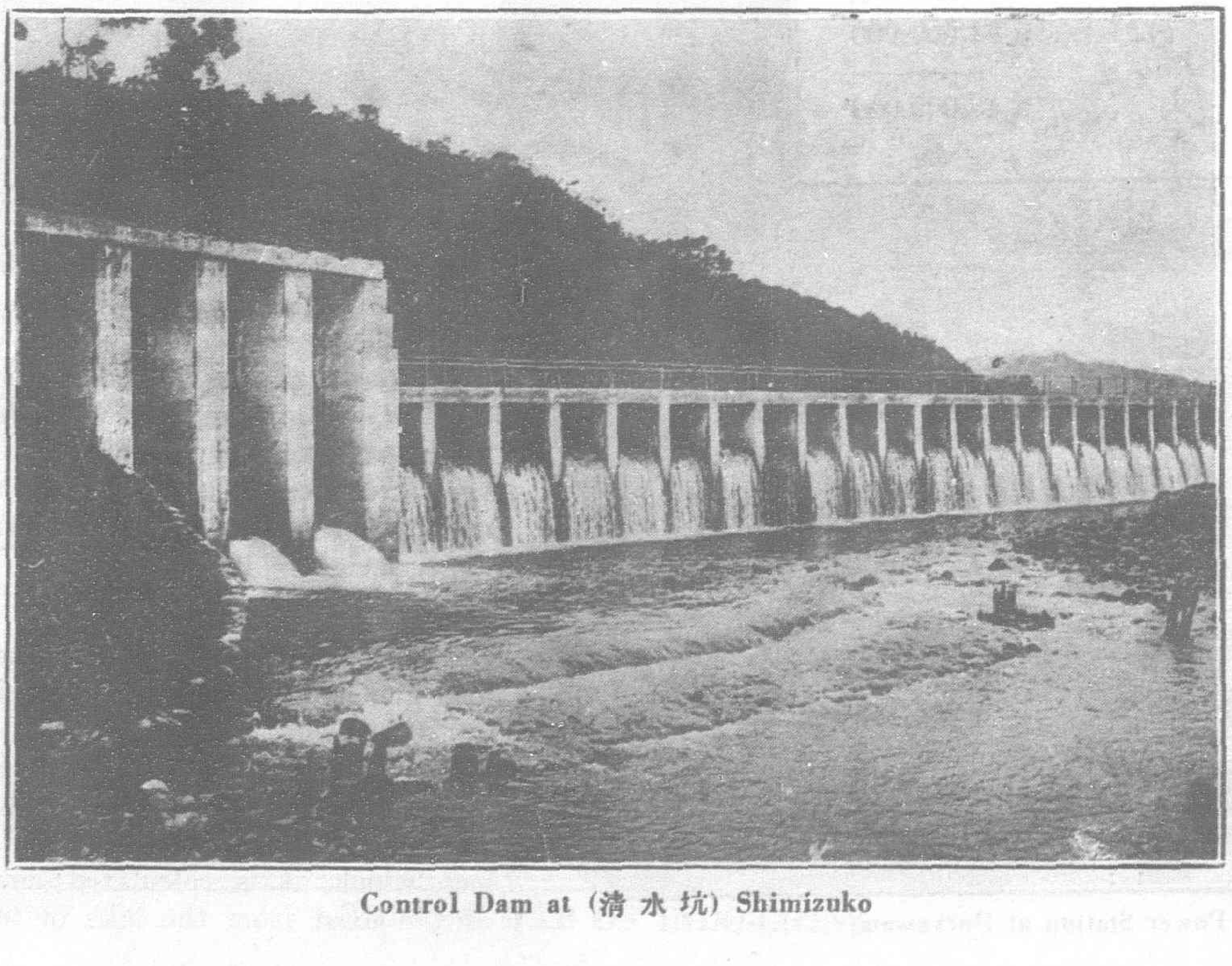


No. 1 Electric Power Station at Kameyama

At ordinary times, allowing for the 1,100-ft. fall mentioned above, it is expected to generate a maximum of 140,000 horse-power, or 100,000 kilowatts, with a minimum of 65,000 kilowatts.

The tunnels will be of horseshoe cross section, and those above the lake will be 19-ft. high by 17-ft. wide, while those leading to the power station will be 15.7-ft. high and 14-ft. in width. It is hoped eventually to construct a second power station some four miles below the first, the water being again carried through tunnels to the point required. A fall of 465-ft. will be obtained, and it is hoped to generate a maximum of 62,000 horse-power. The two stations together would thus produce 202,000 horse-power, giving a maximum of some 145,000 kilowatts, or an average of 95,000 kilowatts. The intention is on completion of the first part of the scheme to transmit electrical energy for light and power all over the island, and the entire electrification of the government railway system is even spoken of.

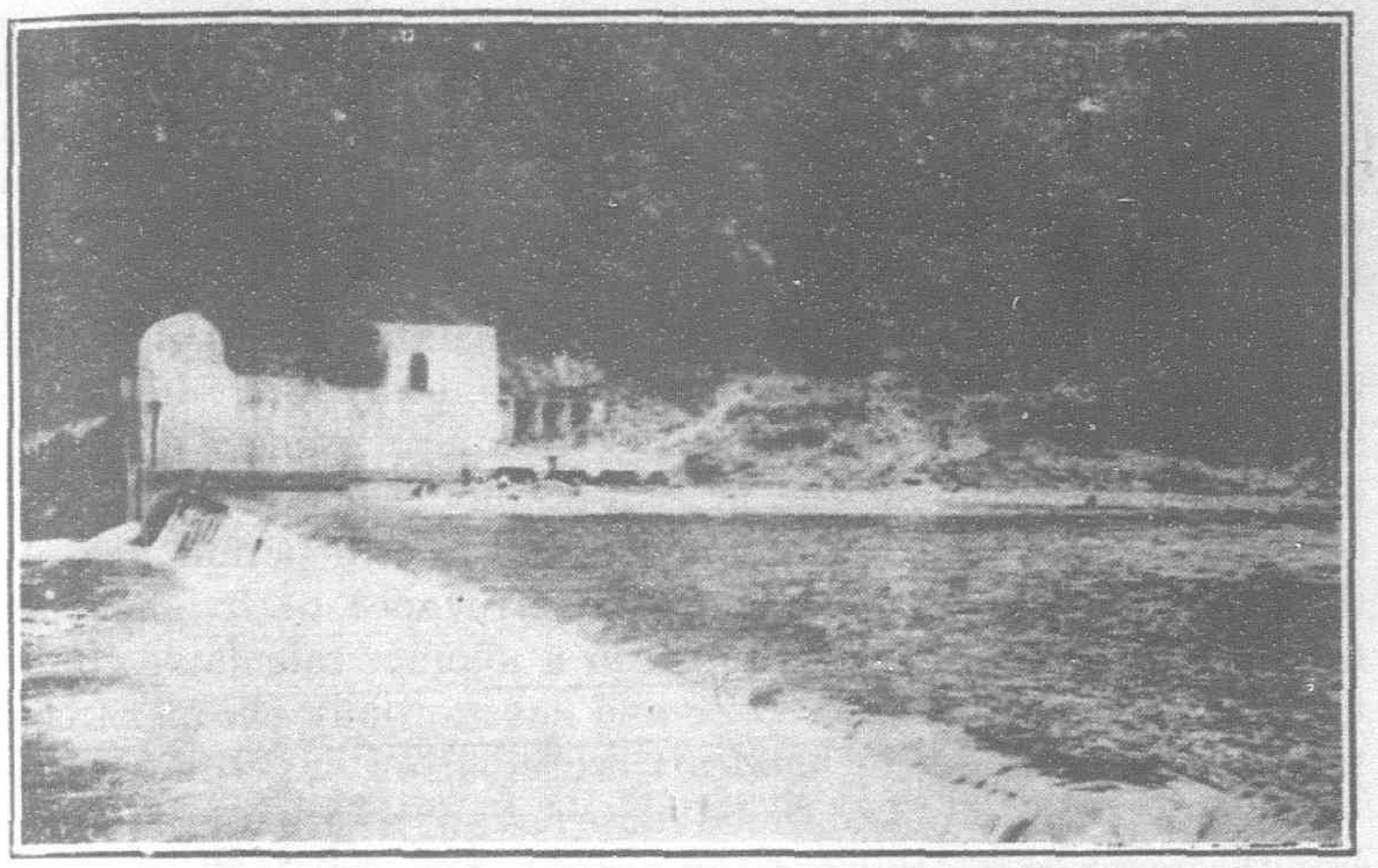
The first step requisite for the carrying out of the scheme described above has been the provision of adequate means of communication in the region covered by the works. The nearest railway station is Nisui, on the main Keelun-Taihoku-Takao line of the Formosan Government Railways, whence the Nisui-Nanto light railway line operated by the Meiji Sugar Company is available as far as the hamlet of Nama, a few miles distant. From Nama a "push car" line runs through Monpaitan, the site of the future main power station, to the town of Horisha and on to Hokusanko, where the preliminary power station is being constructed. The "push cars," it is explained, are small flat-topped trucks running on an 18-in. gauge line, and they are pushed by coolies or, in the case of heavy loads, drawn by oxen.



Control Dam at (清水坑) Shimizuko

This line would have been utterly inadequate to carry the heavy plant and materials required for the execution of the work, so it has been necessary to provide other facilities. A railway of the same gauge as the Formosan government lines, 3-ft. 6-in., is accordingly being built from Nisui to Monpaitan, and from Gaishatei, about one mile below Monpaitan, an aerial ropeway will run to a point above the western shore of Lake Candidius. There, connection will be made with a light railway, operated by electricity and running as far as Suma-an, situated some two miles in a north-easterly direction from the lake, where the offices of the construction department of the company were established in January last. A network of other light railway lines will be constructed for the transport of plant and materials to the various points at which work is to be carried on. Thirty-three miles of light electric railways, 20 miles of "push-car" lines, and 10 miles of aerial ropeways are being constructed, in addition to the line already mentioned from Nisui to Monpaitan.

No electric power being at present available for running the electric lines and ropeways mentioned above and for working the rock drills for piercing the tunnels, it has been necessary to construct a special power station for those purposes. The site selected is at Hokusanko, some four or five miles below the town of Horisha, in the gorge of the Nanko River. A concrete dam with an intake on the right bank of the river has been constructed, and the water will be led through tunnels one mile in length to a point lower down the course of the river, where the power station is now in process of erection. For excavating the rock through which the tunnels pass compressed air drills have been used. On the way down the water will pass through a settling pond for the sand to be deposited. The height of the tunnel is 8-ft. and the breadth about 7-ft., while the depth of the water in the tunnel will be about 7-ft. The fall of water at the power station will be 172-ft. The side walls of the tunnels are faced with brick and the floor is constructed of concrete. The power station building itself was practically completed at the date of the consul's report and the plant was in course of erection. The latter comprises two turbines, each developing 1,200 horse-power. It was expected to complete the installation early in the month of June. Great difficulty was experienced in hauling the heavy machinery up the "push-car" line described above, but the task was accomplished without loss or serious accident. Another difficulty which had to be contended with was the prevalence of malaria in the Hokusanko gorge, which, though it lies at an altitude of some 1,500-ft., is said to be one of the worst malaria spots in the island.



The No. 2 Electric Power Station Dam

The steam railway line from Nisui as far as Gaishatei was expected to be opened in June and the remaining section, from Gaishatei on to Monpaitan, about August. On this latter section a good deal of tunnelling and other work remains to be done and completion may be delayed. The aerial wireway and light railway lines are also all expected to be completed about August next.

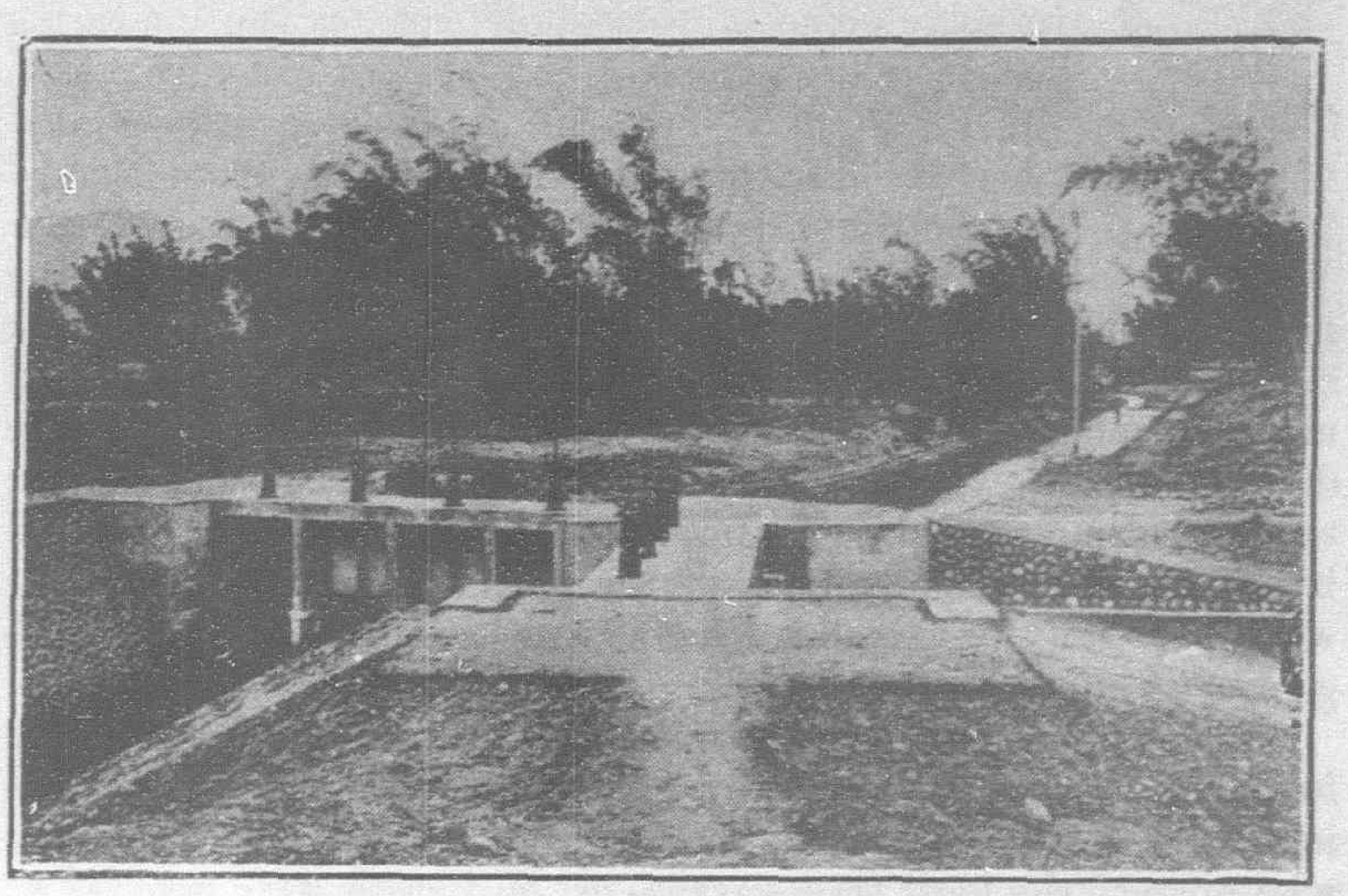
The constructors are fortunate in the practical absence of labor troubles. Labors is plentiful and wages average about Y. 1:20 to Y. 1.50 per day for male laborers and 75 to 90 sen for women. These are, of course, the figures for Formosans, the rates paid to Japanese being considerably higher. The "push-car" coolies are the highest paid of any unskilled labor, their day's wage, it is said, running as high in some cases as Y. 4 or Y. 5. About 4,000 laborers were being employed by the company in constructional work. The prevailing business depression was of benefit to the company, in that it cheapened the rate wages and lowered to some extent the cost of raw materials.

Pending completion of the big scheme, steam power stations are to be constructed at Keelung and Shokwa to furnish additional light and power for the needs of those towns and their vicinity. The Keelung station has already been begun, and work will soon be commenced on that at Shokwa. Keelung enjoys the advantage of cheap fuel, the principal coalfields in the island being situated in its immediate vicinity.

Formosan Electric Power Company

On a much smaller scale than the Lake Candidius project and requiring less time for completion is the installation now under construction in the Giran district of Taihoku province, on the east coast. It was begun as a private enterprise of the Tainan Sugar Company, but the big Taiwan Electric Power Company desired to take a share. It was then decided to form an independent company under the name of the Taiwan Denki Kogyo (Formosa Electrical Enterprise) Company with a capital of Y. 6,000,000, divided into 120,000 Y. 50 shares, of which some were taken up by the Tainan Sugar Company, some by the Taiwan Electric Power Company, some by individual promoters, and the remainder by the general public. The company may eventually be amalgamated with the Taiwan Electric Power Company. Among the promoters are the majority of the most prominent names in the Japanese financial world, such as Mitsui, Iwasaki (Mitsubishi Company), Kaneko (Suzuki & Co.), Okura, Tankata, Asano, Watanabe Kaichi (Ishikawa Shipbuilding Company, Tokio), Wade (Fuji Spinning Company), Yamashita (the shipping magnate), Fujiyama (president of the Tokio chamber of commerce), and others.

The scheme provides for conducting water from the upper course of the river Dakuaui (Giran), a distance of about five miles to Lake Kyukyute, on the bank of which a power station will be built. This involves the cutting of a tunnel over half a mile long, on which work will soon be commenced. The foundations of the power station are already nearly completed. The site is said to be an ideal one, and there are, moreover, other excellent sites further down the course of the river where supplementary power stations can be erected if needed. Work was begun in June, 1920, and it is hoped to have the first power station in operation by the end of 1921 at the latest. A fall of 900 cubic feet of water per second will be obtained and the installation will have a capacity of 10,000 horse-power, or 7,500 kilowatts. A large proportion of the power will be transmitted to the city of Taihoku, some 27 miles distant as the crow flies, and taken over by the Taiwan Electric Power Company. The latter company is under contract to defray the expense of erecting the transmission lines from the installation to Taihoku, and the survey of the route has already been taken in hand. The contract for the erection of the installation—other than the transmission lines mentioned above—has been let to the Okura Gumi, and work is progressing satisfactorily. Owing to the favorable nature of the locality, the cost of erection of the installation has been estimated at only Y. 471 per kilowatt, as compared with Y. 600 to Y. 700 or even as high as Y. 1,000 per kilowatt in Japan.



The Shimizuko Sluice and Head Gate

The Giran district is as yet undeveloped, but it is rich in coal, timber, sulphur and marble. A railway, which will connect the town of Giran with the Taihoku-Keelung line at Hatto, is under construction. Owing to the mountainous nature of the country the line is roundabout and construction difficult, and there is a gap of some 15 miles still to be built, on which work is proceeding apace. It is hoped to use the power produced by the present scheme for the development of the natural resources of the district. The marble will be used for the manufacture of carbide, and eventually it is intended to undertake cement manufacture and the production of timber. The promoters speak of starting work on a second power station in the year 1923 and of following that by a third. On the completion of the latter it is proposed to undertake the production of a nitrogenous fertiliser from the air, but that part of the program is decidedly remote.

Projects also exist for the utilization of the water of the river Daiko, in Taichu province, and of the river Dakko, in Takao province, while a further scheme in Taito prefecture, on the east coast, has been projected by the Taito Sugar Company.

Railless Trams for Shanghai

THE far-seeing management of the Shanghai Tramways whose expansion is considerably handicapped by the restrictions imposed by the authorities, is seeking to solve some of their problems by the increasing use of railless trams. This system has given such favorable results that several new cars have been ordered and will soon be in service. The chassis frames have been manufactured by John I. Thornycroft & Company, Ltd., at their Basingstoke Works, while the car bodies and a number of other parts were built at the works of the Tramway Company in Shanghai. The cars are designed to be driven with a single 40 horsepower ventilated motor supplied by the English Electric Company, Ltd. They are divided into two compartments, the first class being at the front; they are also provided at the front with double lifeguards designed by the Tramway Company while the sides between front and rear wheels are fully protected so that it will be impossible for passengers to be injured by the wheels.

The history of railless cars in Shanghai is contained in the following summary written by Mr. Donald McColl, the general manager of the Shanghai Electric and Construction Company who operate the local tramways:—

"We have had a preliminary railless electric route in operation for nearly six years—a year more than the life of motor omnibuses as stated by the London General Omnibus Co. Our experience shows that the efficient life of railless electric cars will be incomparably longer than that of motor omnibuses.

"The railless electric principle affords speed, carrying capacity and flexibility equal to the motor omnibus on fixed routes; where the volume of traffic justifies the provision of large public-service vehicles regular routes rather than occasional haphazard services, are required.

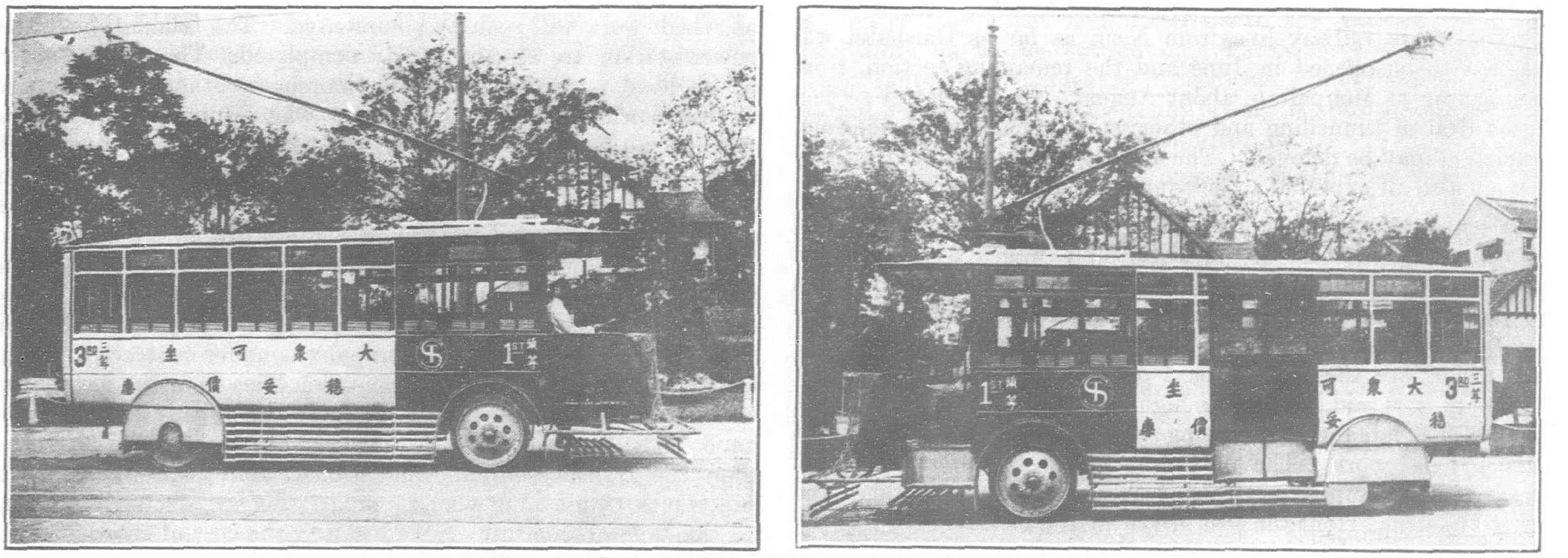
"For roads which are too narrow for double track tramways and with traffic requiring more frequent services than could be run on single track tramways, the railless electric system is the most suitable. Railless cars have the necessary flexibility to thread their way through traffic which would hold up cars confined to rails.

"The railless system is free from certain interruptions to service inseparable from the rail system on which the breakdown or derailment of a single car may hold up a long line of other cars. A disabled railless car can immediately be moved to the side without interruption of the service. A railless electric service has much greater carrying capacity than a single track rail system. For this reason, railless ought to replace the single track rail system on roads which cannot be sufficiently widened for double track and on which a more frequent service is required.

"Double deck dirigible railless vehicles would be subject to the same objection as the double deck rail car inasmuch as the average speed would tend to be less than that of the single deck vehicle on busy routes owing to the time taken by passengers in going up and down stairs at frequent stops. On the whole, the case is stronger for the single deck railless car than for the double deck type for conditions here.

"Published correspondence has acquainted the public with the repeated proposals made by the Tramway Co. during the last few years for a comprehensive scheme of railless extensions designed to supplement the present wholly inadequate passenger services as far as road and bridge facilities will permit and also to relieve the situation as regards conveyance of freight which urgently requires to be dealt with in a manner calculated to give the utmost saving of road space and substantially cheaper freight rates than are possible by handcart, wheelbarrow or petrol trucks.

"Some 16 miles of additional route have at length been approved but the much more onerous terms requested by the council than those for the preliminary railless route render it impossible so far to proceed with the scheme. The high gold prices of imported equipment now ruling involve, at present exchange, much higher capitalization than would have been required early in 1920.

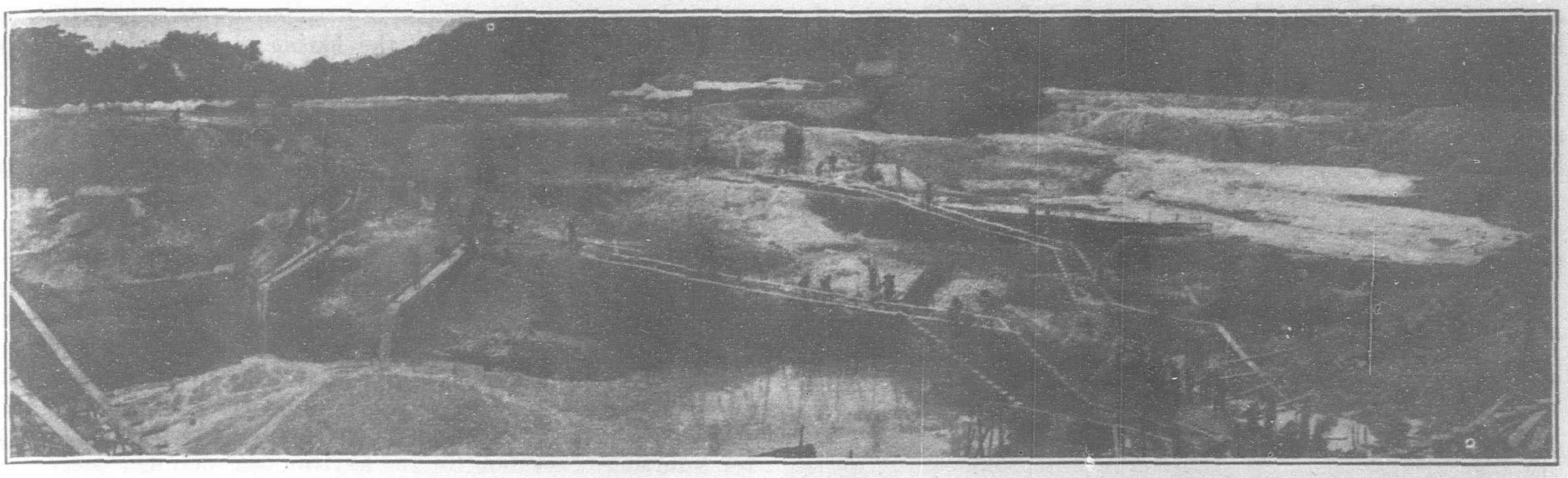


THE NEW RAILLESS TRAMS FOR SHANGHAI

"Successive councils of this settlement seem to have been obsessed by the idea, for which no precedent exists in any part of the world, that the low fares paid by the mass of the population for traveling by the public traction system are the source from which to seek heavy contributions for reconstruction of roads and bridges and other revenues beyond all comparison in excess of the merely nominal license fees levied on other vehicles making similar demands upon roads and bridges. The extensions in question would provide an opening for not much more than 100 railless passenger motor cars.

"Already there are some 200 petrol freight trucks licensed at low rates; and these vehicles are knocking the unprepared roads to pieces.

"At a moderate computation electric traction facilities for 400 million passengers per annum will be required in the foreign settlement within the next few years. This would call for at least 60 miles of route or for the combined administrative areas of Shanghai, 120 miles of route to transport 700 to 800 millions of passengers per annum.



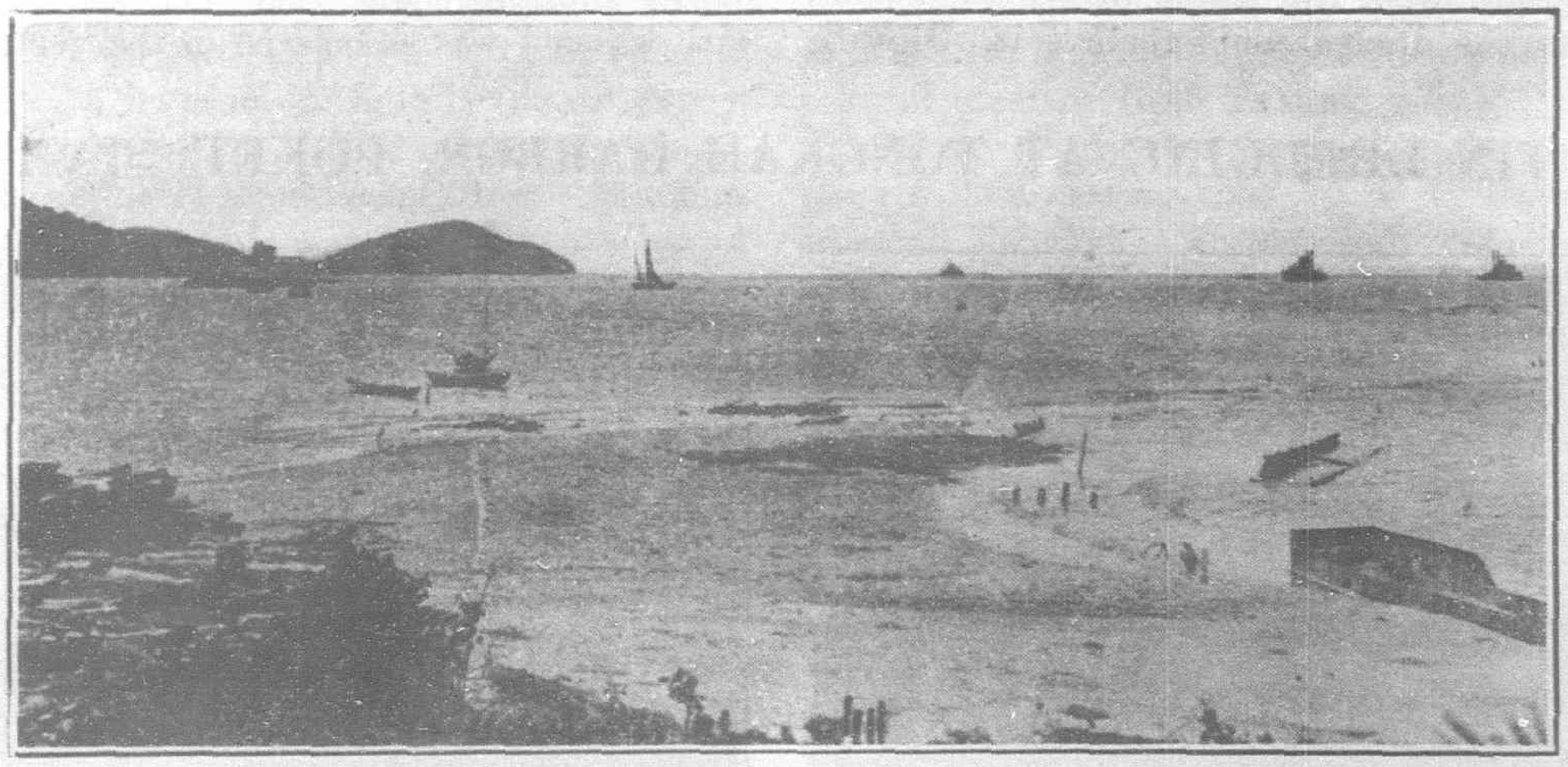
Open Cast Tin Mine at Puket, Siam, showing Sluice; Depth to "Karang" or Tin Bearing Stratum, 25 feet

Tin Dredging in Siam

IN the September number of THE FAR EASTERN REVIEW appeared an article on "Mining in Siam," which gave the particulars as to output and other general data concerning the tin industry of that country. The most important mining development was the introduction of dredges by the Tongkah Harbor Tin Dredging Company, Ltd., who have steadily increased their plant until at the present time they have five dredges at work. The two newest of these have a monthly capacity of about 80,000 cubic yards per month. The example of the Tongkah Harbor Company was soon followed by the Siamese Tin Syndicate and the Renong Dredging Company, who will soon have a total of five dredges at work in Renong. The amount of tin obtained from these dredges is given at 64,992 piculs for 1919-20 as against a total of 74,861 piculs obtained by other mining methods.

The development of tin dredging forms a most interesting chapter in Far Eastern engineering work. Some time ago the founder of the Tongkah Harbor Enterprise, Captain E. T. Miles, of Melbourne, placed on record in the *Industrial Australian and Mining Standard* the history of the early struggles to overcome the prejudices to this new departure in tin mining in Siam. It is worthy of note that the dredging industry in Siam and Malaya owes its inception and finances to Australian initiative, the same as in the Philippines. Captain Miles' story is worth quoting in full.

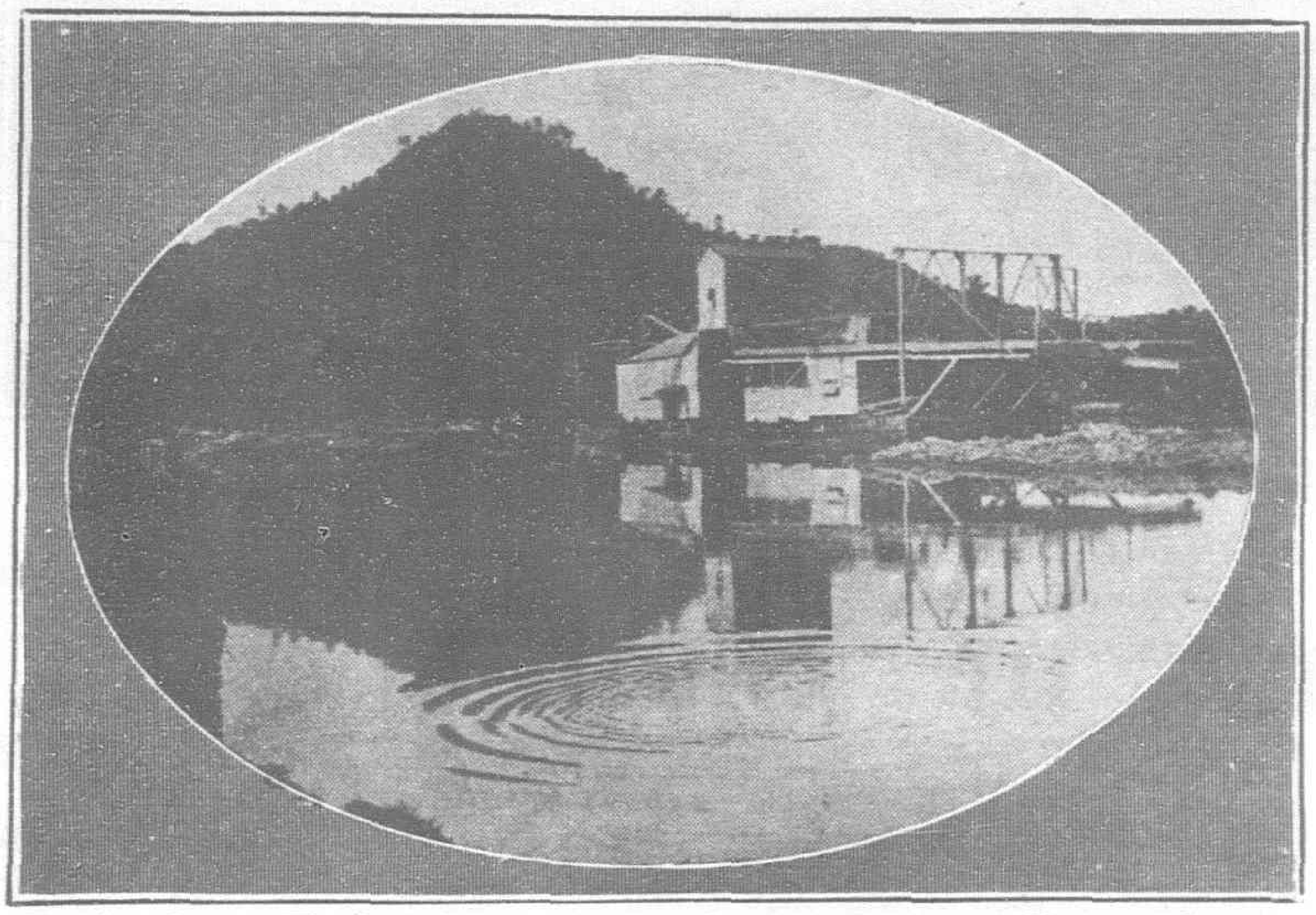
Much has been said and written at various times on the origin of tin-dredging in Siam and Malaya, most of it erroneous, some with a smattering of truth. Men who were the greatest pessimists, who did their best to block the flotation of the pioneer company, and ridiculed the idea of successfully dredging tin from Tongkah harbor, have since publicly claimed the credit of being the pioneers of tin-dredging in Siam and Malaya. For record purposes I propose to state a few facts on the origin of the industry.



Tin Dredges at Work in the Sea, Tongkah Harbor, Puket, Siam

On the invitation of the late H.E. Phya Raseda, high commissioner of Western Siam, I went to Tongkah in 1905 to investigate what was then known as the government compound, an area of about 50 acres in the centre of the township, on which stood all the government buildings, comprising the high commissioner's and the governor's offices, treasury, mines office, gaol, police office, etc. This area was practically all that was left unworked of the valley which Chinese had been working for tin for 60 or 70 years. Starting from the foot-hills, they had worked down the valley to the foreshores of the harbor, and by means of a series of cofferdams for a quarter of a mile into the shallowest part of the harbor, leaving unworked the compound. This latter had been extensively bored by a government boring gang, under Boring-Superintendent McLellan. I carefully checked the bores, and satisfied myself that this area would average about 2-lb. per cubic yard, but, while the government had fixed their compensation for removal of buildings at about £20,000, compensation to private owners was left for settlement between the parties, and was consequently an unknown quantity. I pointed out to the high commissioner that this unknown quantity would be a bar to the flotation of a company in Australia or elsewhere, and advised him to have the value of private improvements assessed and added to the government's compensation, so that the actual cost could be shown to promoters. This was done some years later, the outcome being that A. W. Palfreyman courageously came to the rescue on the last days of the option and took a huge liability, resulting in the flotation of the Tongkah Compound Co., which has been exceedingly profitable to all concerned. But it must be remembered that at this later period the Tongkah Harbor Co. had been at work for some considerable a time, and had demonstrated that ground of similar character to the compound could be worked for 4d. per yard. Without that knowledge anyone asking the business men of Australia to put up £50,000, plus the cost of a dredge and plant to work 50 acres of ground, would have been regarded as fit inmate of a lunatic asylum.

At the time of my visit to Tongkah about 600 coolies were, by means of a series of cofferdams, working two open lombongs at least a quarter of a mile out in the harbor, beyond original high-water mark; and while at this time the financial difficulties of the compound seemed insuperable, the harbor and its possibilities appealed to my nautical instincts. I feel sure that the ordinary mining engineer would not have tackled the harbor at that time, for it was more a marine than an engineering problem. Chinese are very jealous of any stranger, particularly a European, going into their mines, but an introduction from the high commissioner removed all disabilities as far as I was concerned, and I had free access to the workings, and was consequently enabled to ascertain, by personal observation, the number of men employed, the quantity of cassiterite produced daily, and the nature and extent of the *karang* (tin-bearing gravel). Above all, the mines being dry, I had an opportunity of seeing what no other European has since seen, the character of the overburden from surface to *kong* (the bottom under *karang*), and I was convinced that similar clay overburden in the harbor would stand the test of dredging.


Tin Dredge at Work Inland at Puket, Siam. Capacity of Dredge about 65,000 cubic yards per month.

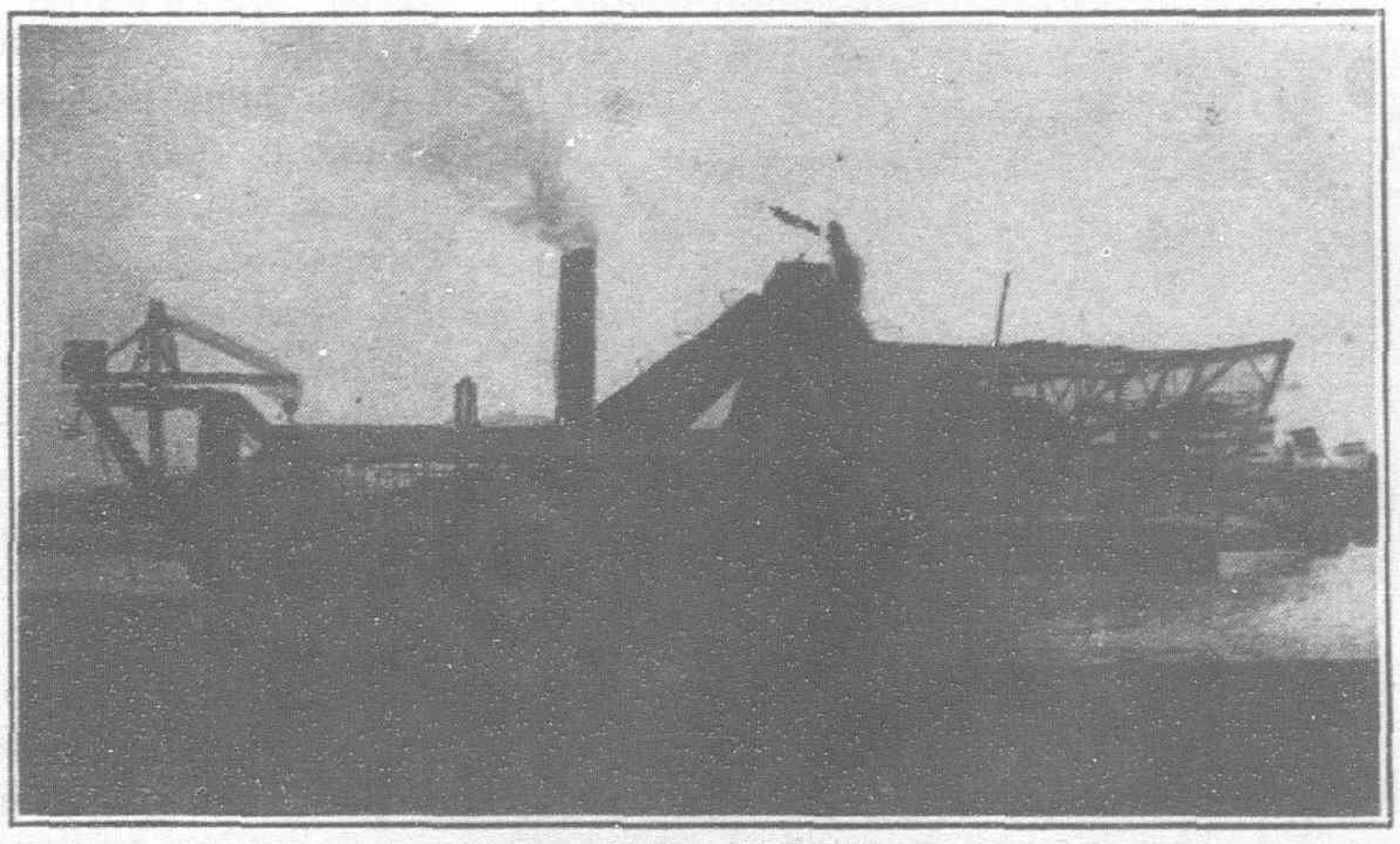
Whether Tongkah harbor could be successfully and profitably worked by dredging depended upon whether, in opening a paddock, the banks would stand, or whether, with the ebb and flow of the tide, together with the ocean swell, the banks would fall in and fill the paddock as fast as the dredge could remove it. Having satisfied myself on this point, the next move was to ascertain how far the deposit extended into the harbor, and whether the depth was within the limits of economical dredging. I borrowed a boring set and put down sufficient bores in the harbor to satisfy myself that the deposit extended at least a mile into the harbor, and that it was of the same value and character as that seen in the open mines.

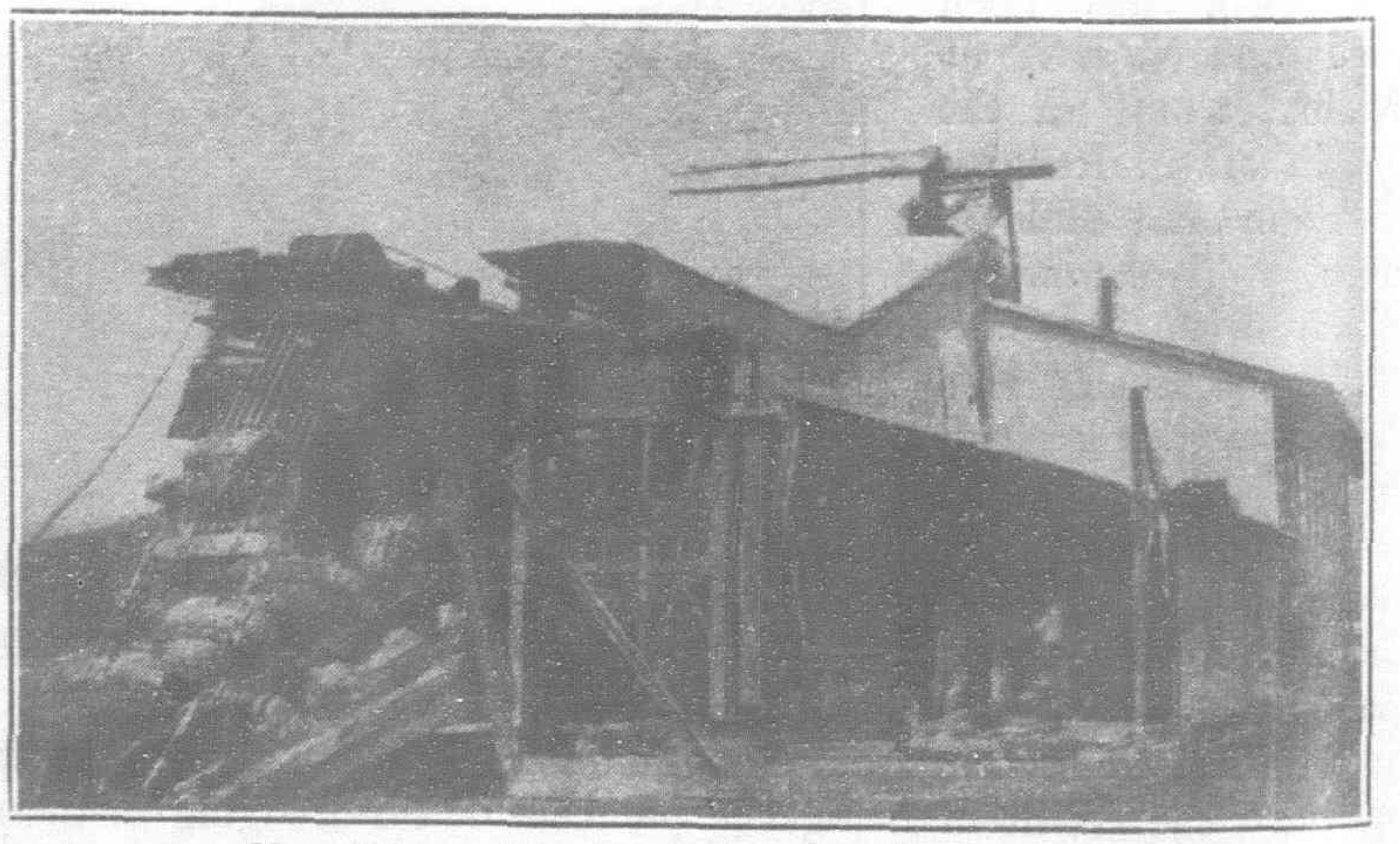
The problem before me thus was: Can the harbor be worked to pay 15 or 20 per cent. interest, and return the invested capital during the life of the mine with 70 per cent. concentrate, worth only 8d. per lb.? Metallic tin was then about £125 per ton. I had estimated the cost of working the lombongs by Chinese methods at 1s. 1d. per cubic yard, and concluded that as the same ground could be worked by dredge at about 4d. per yard, there must be a huge profit. Holding this view, I made application to the high commissioner for a mining concession for the harbor, but was met with a refusal, on the ground that the working of the mine so far seaward was causing their only channel, which carried all the traffic, to silt up, and the government had refused the Chinese permission to mine any further seaward on that account. This raised the "dock and channel" question, about which so much was said and written a few years back by ill-informed critics. After full consideration. I undertook, if the government gave me the sole right to dredge the whole of the harbor (about 6 square miles) to dig a dock and a channel thereto, 20-ft. deep. I made a glowing picture of a dock, with all the gunboats, steamers and tonkongs discharging at a wharf, instead of lying three miles off and discharging into lighters, and impressed the officials with the advantages, both in cost and convenience. About this time Prince Dameong, then minister for the interior, came to Tongkah, and I discussed the possibilities with him, with the result that he instructed me to prepare a draft concession for his approval, and present it at the mines department at Bangkok. The original draft I have in my possession, and it is very gratifying to me that it ran the gauntlet of a special commission, which included officials of the highest standing in the Siamese government, both Siamese and European, and came through without any appreciable alteration from the original text.

It is a matter of history that some years later the Tongkah Harbor Co. compromised with the Siamese government, and, in lieu of digging the dock and channel, agreed to pay £35,000, spread over 5 years, and do some minor dredging in the boat channel. It is worthy of note that previous to this compromise I had offered the Tongkah Harbor Co. a very large sum for the right to dig the dock and channel, taking as compensation for the work the tin recovered from the area during the operations.

After securing the concession, the feasibility of dredging the harbor profitably was still doubted. At one stage the friends with whom I was associated in the venture discussed the question

TIN DREDGING AT TONGKAH HARBOR, PUKET, SIAM

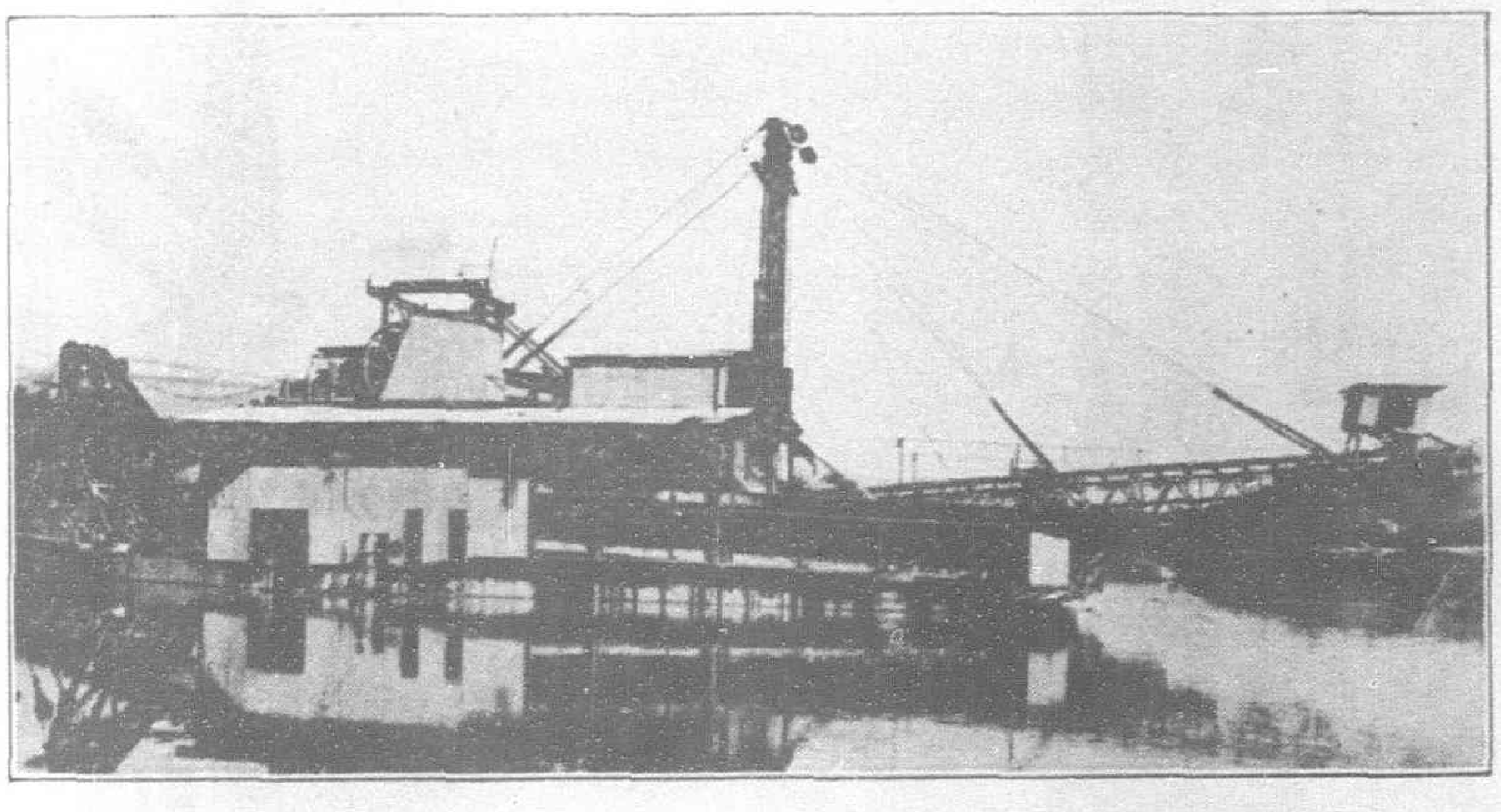

General View of Dredge


Near View of Dredge, Showing Close-connected Type of Bucket Ladder

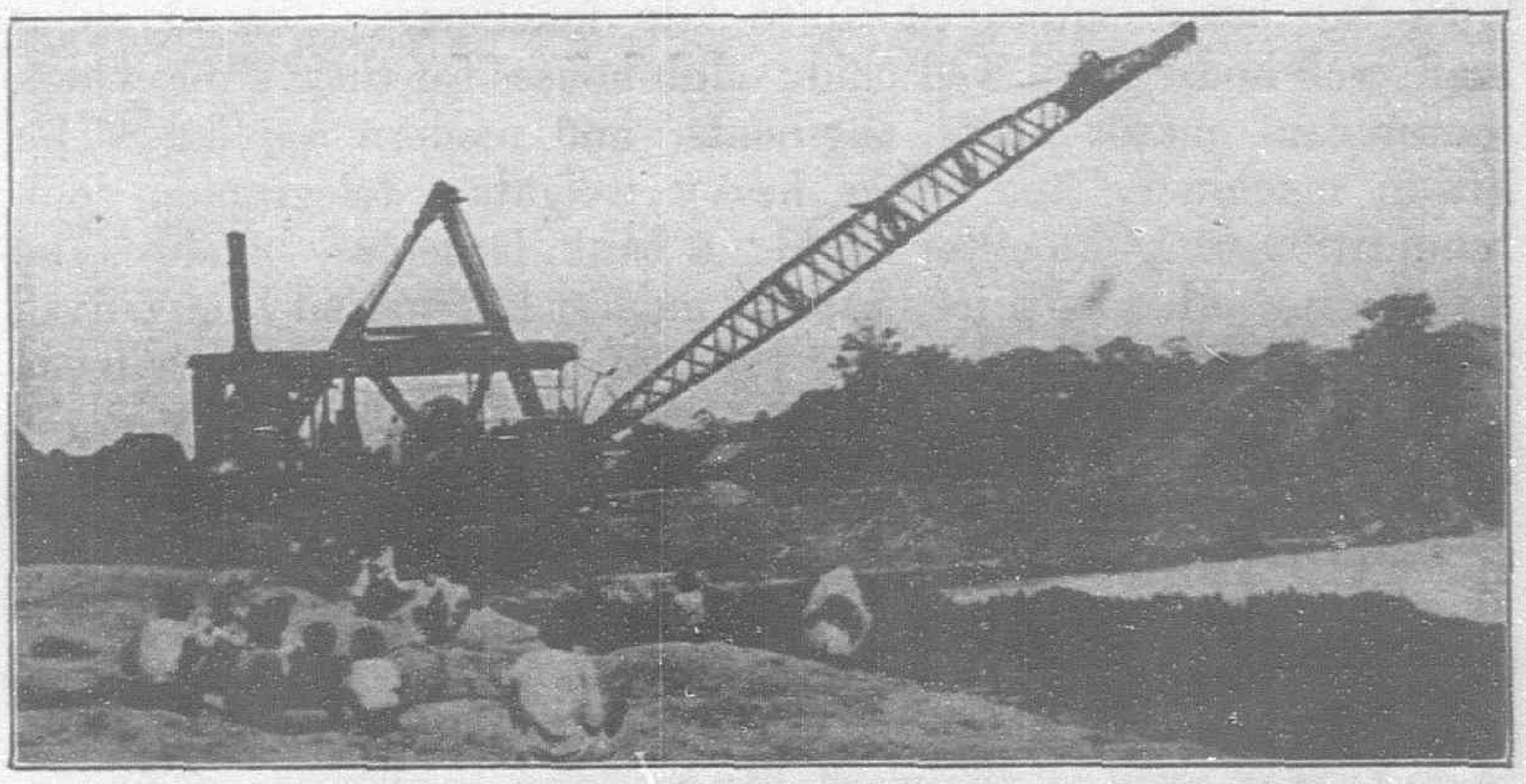
of abandoning the project, and it was probably the prompt action of a leading Melbourne investor, who has always been foremost in assisting the flotation of these Eastern ventures, that decided the question and retained the concession for Hobart.

As showing the difference between the ambitious flotation schemes of to-day and those of 1906, we essayed to float the Tongkah Harbor Co., pay preliminary expenses, cost of flotation and re-registration, build a dredge, transport it to Penang, re-erect it there, tow it to Tongkah (180 miles), purchase fuel, provide dwellings for our men, dressing shed, floating plant, spares, etc., and pay salaries during the re-erecting period, with a paid-up capital of only £17,500, to provide which 35,000 shares were issued at 10s. In these days of extravagance this sum would be considered ridiculous, but the fact remains that all the work enumerated above was done and paid for out of £17,500. It is true, however, that during the opening-up period, and before getting down on tin, my bank balance was reduced to 30 dollars credit, while the outstanding liabilities amounted to £200, with nearly two-thirds of a month's wages due, and still no tin. At this stage a Chinese friend, resident in Tongkah, who was a comparatively large shareholder and knew the financial position of the company fairly well, interviewed me, and the following dialogue ensued: "You haven't much money, Capt. Miles?" "I think I have all I need." "Well, I don't think you have; and if you want 10 or 15 thousand dollars, send a chit (note) up to me, and I will send it down." "I have authority to do many things, but I don't think I have authority to borrow money." "No, I don't mean the company; I mean you. If you want the money I will send it to you." "But I might never be able to repay you." "Never mind that; if you can repay me you will; if not, I will forgive you." He left me after getting a promise that if I needed the money I would send for it. It was a kindly and generous offer of assistance from a friend who believed I needed it, in marked contrast with the usual offer of assistance when it is not needed. The assistance, however, was not required, for two days later we were down on tin, and at the end of the month had a nice little parcel in the store which cleared up all outstandings; but it was a close shave. If we had been compelled to make a call before getting down on tin, the Tongkah Harbor Co. would, in all probability, have gone into liquidation, and the dredging industry in the East would have been set back a quarter of a century.

BUCYRUS DREDGES IN SIAM AND F.M.S.



7 cu. ft. Dredge for Tin Bentong, No Liability, Melbourne now at work in Federated Malay States



Class 175-B one of the three Dragline Excavators Working on Large Irrigation System for Siamese Government

No. 1 dredge was built in Glasgow, transported to Penang, and re-erected at the Prye Dock in 1907. Prince Dameong publicly started the machinery on November 4, 1907. Then came the problem of towing the dredge to Tongkah. No steamship company would undertake the responsibility, neither would any insurance company take the risk. It was the generally expressed opinion of the Europeans that the dredge would never reach Tongkah. One could understand the Chinese and native population, who had never seen or probably heard of such a piece of machinery as a dredge, being sceptical, but the insistence with which the European section of the community opposed everything connected with the dredge and dredging is incredible. It may have been from ignorance, or, more probably, from jealousy of a stranger coming there and supplanting them in an industry which they regarded as their own. The only choice left me was to hire a small steamer, with a native crew, capable, in fine weather, of towing the dredge three miles an hour. The dredge went uninsured, and I had to guarantee the owners of the steamer her full value in case of loss. My son took charge of the dredge and those on board, and I navigated the steamer. For the first twelve hours we had a rough time with a nasty troublesome beam sea; after that we got inside of a chain of islands skirting the coast, and fared better. On the third might, about 10 p.m., we anchored in Tongkah harbor, having had little food or sleep for three days. We only got the anchor down just in time, for within two hours a gale sprang up from the westward, and blew with hurricane violence for several days. Had it caught us crossing the open sea, anything might have happened; to run back to the islands for shelter would have involved turning round broadside to wind and sea, which, with her top hammer, would have been most dangerous. However, the Miles luck prevailed; we got there without accident, and without insurance. Two days later we were dredging Tongkah harbor.

The early dredging difficulties were stupendous. There were many things we needed, but, being short of capital, had to wait for them until we could dig them out of the ground. Tongkah at that time had no telegraphic communication, and was served by a small steamer from Penang weekly; there was no engineering shop of any description; even a 3-in. bolt had to come from Penang; the smallest casting took 10 or 12 days, and frequently longer, to reach Tongkah. To get fresh water for boilers we had to tow a punt up the creek on flood tide, wait until the stream was fresh at low water, fill the punt with buckets, and wait again for the next high water to float the punt and tow her down on the ebb. Thus it took two days to get a punt load of water to the dredge. Fuel was another trouble; the natives had been in the habit of cutting wood a certain size and selling it at so much per 100 pieces, and it was with the greatest difficulty that I could persuade them to cut wood suitable for the dredge. Then came the transport. We had nothing but small open sampans to carry 15 to 20 tons of firewood daily to the dredge, and this work occupied the whole 24 hours. On more than one occasion, to prevent the dredge stopping, my sons and I had to turn out at night, load up a couple of sampans, and take them out to the dredge; no other labor was available, and it was a case of stopping the dredge or carting the wood.

The labor troubles were immense. The natives were afraid of the machinery, afraid of working in the dark, afraid of European employers, who had the reputation of treating them badly, and at first positively refused to work on the dredge. By dint of persuasion, kindly treatment, and prompt payment, we got first one and then another, and finally a crew, who soon found that it was not a bad job; they were well paid, not ill-used, and had electric light at night to work by. Fortunately, we had no accidents. If one of them had been killed or seriously injured in the early stages, the dredge would have been doomed as "bad joss." After a time my trouble with the Asiatic employees ceased, and the source of trouble then was the Europeans, some of whom would persist in bullying and ill-treating the Asiatics, and finally I was compelled to insist upon the natives being treated as human beings and not as brutes. On more than one occasion I was obliged to get rid of an otherwise good European because of his treatment of the Asiatic. Under Asiatic custom, all the members obey the head of the family, be he grandfather, father, or elder brother, and so with the head man of the village or the head man of a *kongsi*. Under their custom, while it was quite proper for me, as *towkay* of the dredging company, to chastise them if they did wrong, if was improper for any of my subordinates to do so. They will accept chastisement from the head man without a murmur, but resent it coming from anyone else.

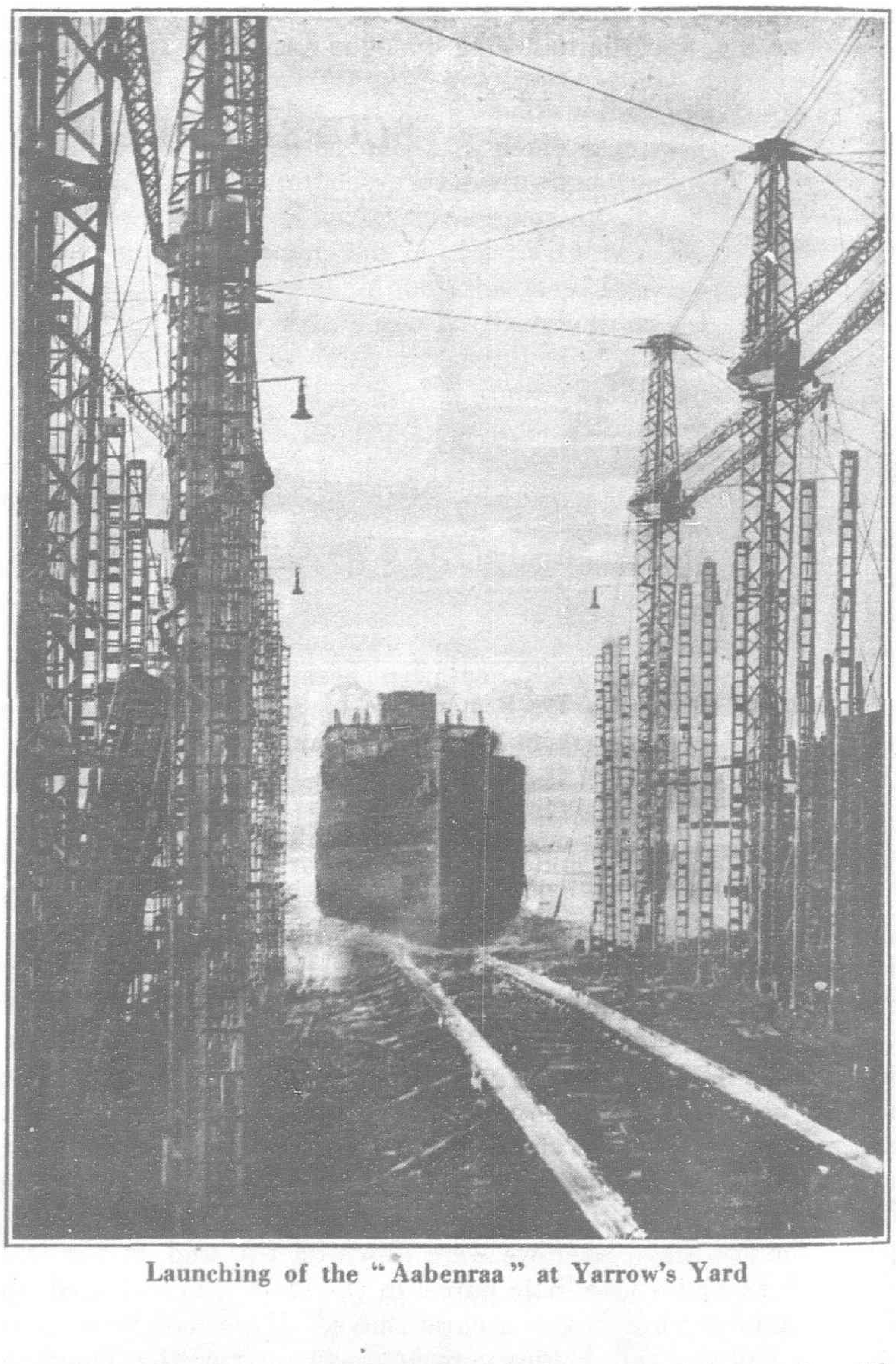
One could go on enumerating the difficulties of the early pioneers, which time and circumstance have much changed. In Tongkah now, the manager has quite an imposing residence in the healthiest locality. I lived in a Chinese-built house in which there had been several cases of plague. They have a first-class workshop, with the latest improved up-to-date machinery; an excellent staff, well housed and well paid; club-houses for their amusement, motor cars, motor boats, tug-boats, and modern appliances for lifting machinery and other heavy weights; telegraphic communication with the outer world; a bank, large case balance, and tin at a much higher price than my modest £125; and I have lived to see my optimistic dream of 1905, of the future of dredging in the East, fully realized.

But there is cause for concern in the high capitalization and ever-increasing operating costs of present-day companies, and if the pioneers had been imbued with the extravagant ideas of some latter-day-promoters, there might have been no Tongkah Harbor Co., and probably no tin-dredging in the East to-day. But dredging is there to stay until all the workable dredging ground is exhausted. There is little 2-lb. ground left, and not a great deal of ground worth 1-lb. The dredging of the future will be chiefly in ground of under a pound per cubic yard value, and hence after the war it will be necessary to exercise economy in every direction to enable shareholders to get a fair return for their investments.

But it is so much easier to increase than to reduce expenditure; and I fear the enormous earning power of the companies during the war may have created extravagant habits that will be difficult to shake off. Take the item of labor as an illustration. The coolies of 1905 considered himself well paid at 60 cents per day; increases have been periodically made until the best of them to-day get $2. A Chinese mechanic in 1905 was paid $1.50; the rivalry and competition between the companies for mechanics accustomed to dredge work is now so keen that these men are offered inducements to go from one company to another, each time at increased rates, until they now get from $4 to $5 per day; and so with Europeans. It is quite a common occurrence to find a man whose passage has been paid from Australia or England on a three years' contract, after a few months' or a year's service, working for another company, which did not provide his passage, at much higher rate. In addition to the increased wages, the numbers have increased to such an extent that there are now employed on and about a dredge 50 per cent. more men than was originally considered sufficient to do the work. It will be difficult to alter these working conditions, and the economical dredging of low-grade ground in the future would appear to lie in the direction of improvements in the machinery to enable more ground to be treated per month with the same number of hands. If this can be done, dredging low-grade ground may survive an ugly reverse in the market; if not, many thousands of tons of tin will remain in the ground.

Yarrow Launchings

THE steamer *Aabenraa* built for the Nordosterso Rederiet of Copenhagen was launched from Yarrow & Company's yard at Scotstoun, near Glasgow, on August 31st. She is a single deck steamer with forecastle, long bridge and poop. The length is 286-ft., beam 43-ft. 6-in., and depth 21-ft., the gross tonnage is 2,211 and the deadweight carrying capacity 3,500 tons on 19-ft. draft. There are three holds with four exceptionally large hatches (24-ft. by 20-ft.), one 10-ton derrick, five 3-ton derricks and six winches. The machinery consists of triple-expansion engines 20½-in., 33-in., and 54-in. diameter with a stroke of 36-in., and two boilers 13-ft. 6-in. diameter by 10-ft. 6-in. long for a working pressure of 180-lbs. per square inch, fitted with superheaters. The machinery has been constructed by Yarrow & Co., Ltd., and is now being fitted on board. On September 29th, the steamer *Essonite* built and engined to the order of Mr. Wm. Robertson of Glasgow, was also launched.



Launching of the "Aabenraa" at Yarrow's Yard

The *Essonite* is a "well-deck" vessel, having forecastle with long raised quarter deck and bridge combined, the machinery being placed aft. The deadweight capacity is 800 tons on a draft of 13-ft. 6-in. The length is 175-ft. between perpendiculars, breadth 28-ft. and depth 13-ft. 6-in. There are two hatches each served by a derrick and a 3-ton winch. Triple-expansion engines $\frac{\text{15-in., 25½-in. and 14-in.}}{\text{30-in.}}$ derive steam from two boilers 11-ft. diameter by 10-ft. long, designed for a working pressure of 180-lbs. per square inch. The vessel will steam at about 10 knots, has been constructed to class Lloyd's 100 A1 and is fitted with electric light throughout.

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